Rock Products

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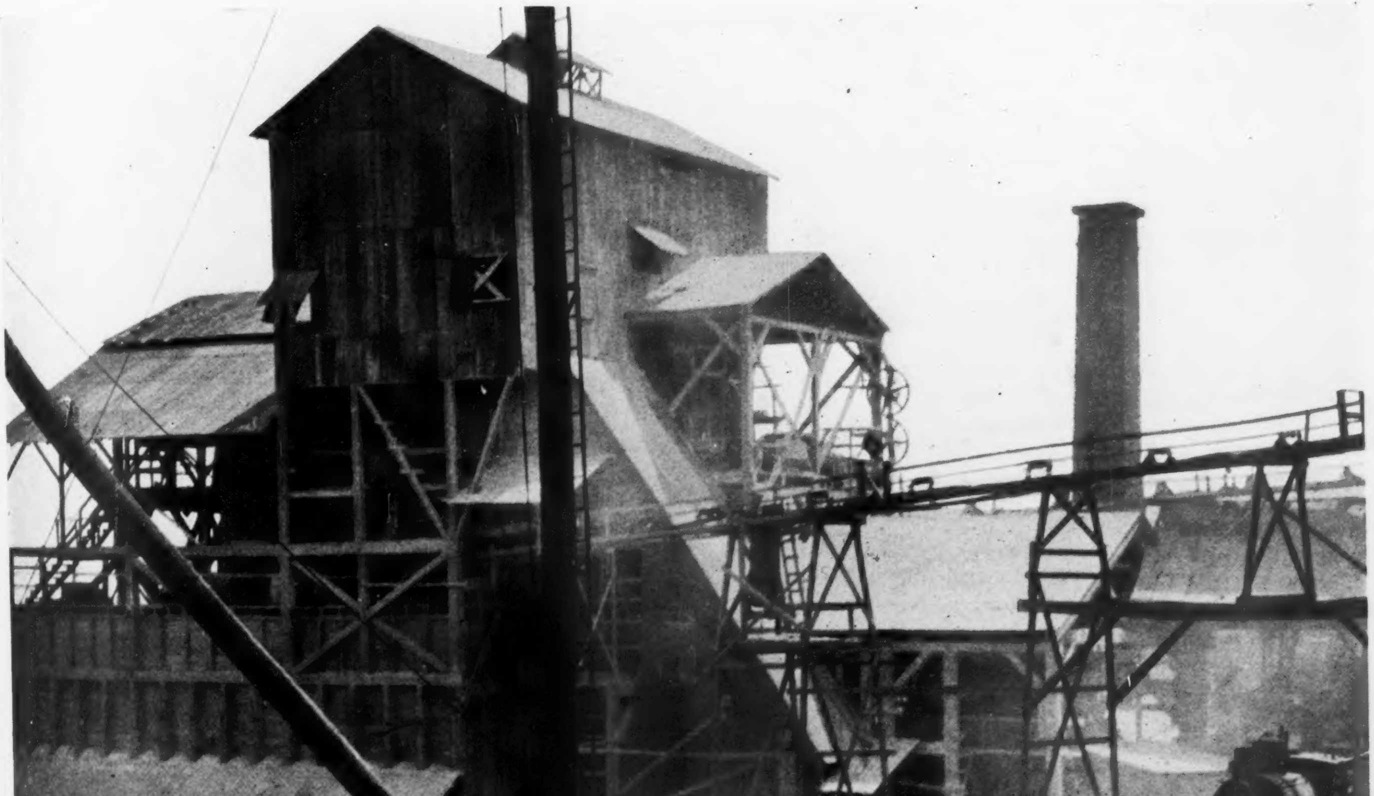


Crushed stone plant of the Dittlinger Lime Co. Mexican workmen separate kiln feed from crushing plant feed, as shown in the foreground

Electrification of Rock Crushing and Lime Hydrating Plants

Dittlinger Lime Co.'s Plant Has Motorization System with Original Features

By N. Bernard Gussett
Assistant Engineer, South Texas Public Service Co., San Antonio, Texas

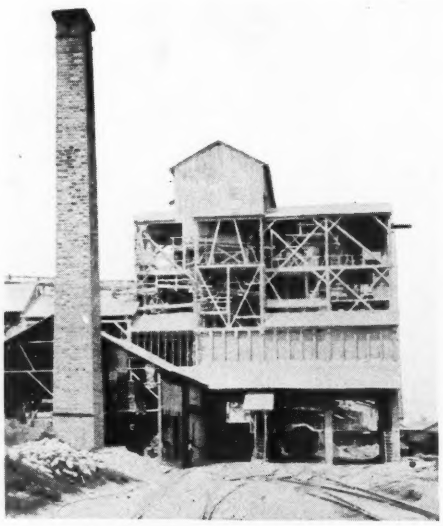
WITHIN the last few years great strides have been made by the electrical industry in Texas. Thousands of miles of transmission line have been woven into a network over the entire state, great power stations have been erected and vast territories that had hardly a hope of receiving electric service are now served.

In line with this development came the construction of the Comal power plant at New Braunfels and the running of transmission lines to serve San Antonio and its widespread trades territory.

Located in this territory, almost on a high voltage high capacity line and five miles south of the source of power at New Braunfels, the Dittlinger, Texas, plant of the Dittlinger Lime Co. offered an excellent opportunity to determine the adaptability of electric drive to a large rock crushing and lime burning plant.

Quarry and Kiln Practice

Plant and quarry have been in operation for a number of years. The quarry has a face about half a mile long and 75 ft. high. A Keystone, a Sanderson-Cyclone and a Loomis Clipper drill are all used in putting down holes which are set 15 ft. apart and carry 20 ft. burden. The fragmentation is not so complete as at some quarries, but one of the aims of blasting is to make a lot of big pieces to be shipped for rip-rap.



Stack made of cement block and put up with lime motor which has served the power plant for 12 years

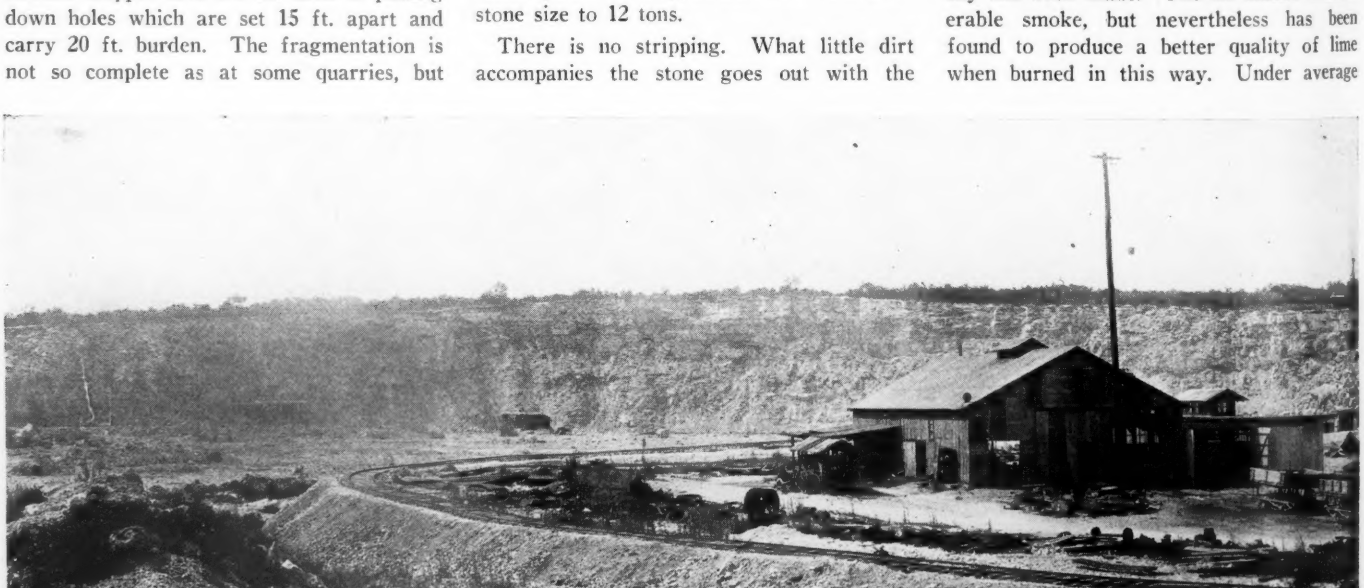
These pieces as shipped run from one-man-stone size to 12 tons.

There is no stripping. What little dirt accompanies the stone goes out with the screenings passing a 1-in. screen. They are piled in an unused part of the quarry and sold to railroads for covering ballast and to counties and townships for making roads. They have unusual self-cementing qualities and are sold in large quantities in the road making season.

The lime plant has five interesting kilns which were designed and built at the plant. They are 47 ft. high above the charging floor and of 12 ft. outside diameter. The upper 18 ft. is used as a reservoir for stone. The burning zone is rectangular, 5 ft. 6-in. wide by 7 ft. long, and the firing is done through two "eyes" on the long side.

Oil is used for fuel. The Bethlehem burner that is used merely sprays the oil into the firebox without any atomization by steam or air and this has been found the most economical way of using oil for lime burning. But atomizing burners have to be used to heat the kiln after a shutdown in order to save time, and two of these are set on either side of the main burner.

Coal was tried as fuel at first and 10 tons per kiln was the highest output obtained. With oil as much as 18 tons of lime per day has been made. The oil makes considerable smoke, but nevertheless has been found to produce a better quality of lime when burned in this way. Under average



The quarry, showing the permanent track to the face and the house for air compressors and blacksmith and machine shop

Plant of Dittlinger Lime Co. near New Braunfels, Texas. Crushing plant at left; kilns at center and two hydrating plants at the right

conditions 80 cars of rock are shipped daily. The lime plant turns out 3 tons per hour, part of it passing to two hydrating plants.

Two tests were made to determine the efficiency of electrification.

Original Steam Plant

At the time of the original test the rock crusher was pulled with two single cylinder non-condensing Corliss engines operating on steam at a pressure of 100 lb. per sq. in. One of these engines was belted to the primary shaft which pulled a No. 12 primary crusher handling 250 tons per hour, a No. 5 secondary crusher handling 75 tons per hour, a primary elevator with 36-in. buckets handling 500,000 lb. per hour up a 57½-ft. lift and a partially loaded Fairbanks-Morse 25 kw., 110 v., d. c. generator. All these crushers and the elevator are of Allis-Chalmers make. The other engine was belted to the secondary or tail shaft which pulled a Williams No. 2 crusher handling 25 tons per hour, a Gates No. 5 crusher handling 90 tons per hour, a Williams No. 4 hammer mill crushing 90 tons per hour, a dirt elevator handling 75 tons per hour over an 84-ft. lift, a rock elevator handling 175 tons per hour over a 97½-ft. lift, two Laughlin No. 1 screens handling 1500 lb. per hour each, one Laughlin No. 1 screen handling 1000 lb. per hour, four Laughlin No. 1 screens handling 50 tons per hour each, a Tyler vibrator screen handling 3 tons per hour, two 250-ft. belt conveyors, each handling 50 tons an hour, a Simond's No. 3 crusher handling 25 tons per hour, two belt conveyors each handling 20 tons an hour over a 39-ft. lift and a few short and unimportant conveyors.

The lime plant was pulled by a battery of boilers but an attempt had already been made at partial electrification. The plant was divided into two complete hydrating units, one slightly older than the other, and for that reason they are referred to as the old plant and the new plant respectively.

The old plant was pulled by a 12x26-in. single Corliss engine operating at 96 r.p.m. on steam at a pressure of 100 lb. This engine was belted to the main line shaft which carried a Sturtevant open-door rotary crusher handling seven tons per hour, a Kritzer 3½-ton hydrator, a Raymond 3½-ton pulverizer, a Valve Bag Co.'s 3½-ton bagger, an S. Howe 3½-ton cloth sack bagger, a Valve Bag Co.'s 3½-ton agricultural lime bagger, three blowers, a Gray 3½-ton scalping screen, a Weller 3-ton mixer and the necessary elevators and conveyors.

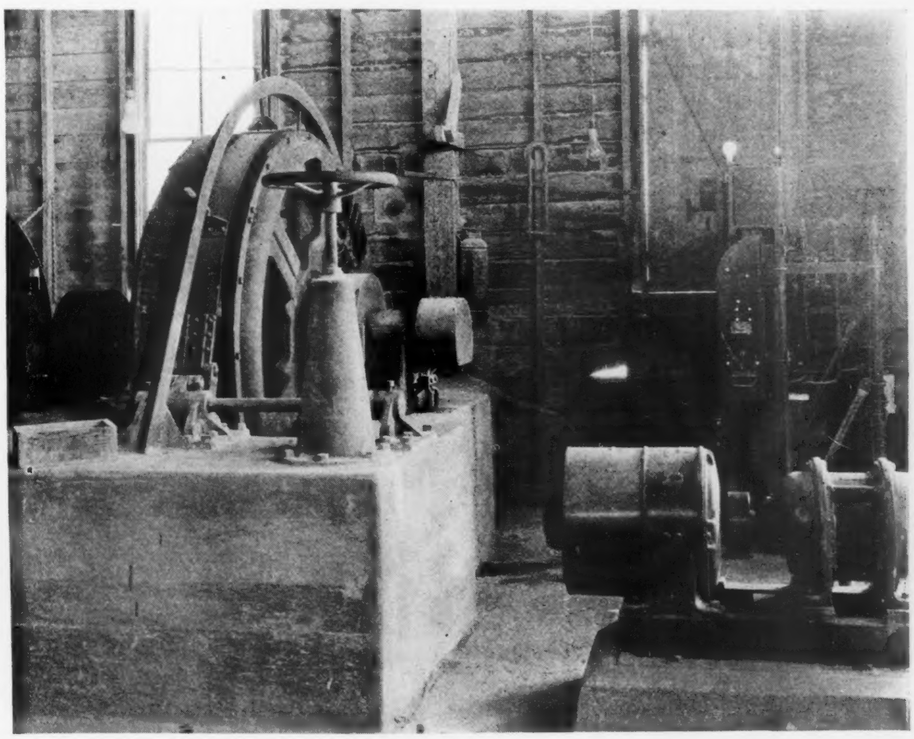
Small Turbo-Generator Set Previously Used

The new plant had a 60-hp. motor driven by a small turbo-generator set. The motor was belted to the line shaft which carried a Clyde 3½-ton hydrator, a Gray 3½-ton scalping screen, a Pennsylvania crusher, one Raymond 3½-ton mill, a Raymond exhauster fan, a Valve Bag Co.'s 3½-ton bagger, a blower and the necessary elevators and conveyors. It was found that the motor was too small to pull the entire load and it was possible to operate only one-half of the plant at a time.

The boilers for the lime plant also handled the air compressor, the house service and fire pumps, a large derrick hoist which filled the kiln feed cars with rock, and a car hoist which pulled the cars up an inclined track to the level of the top of the kilns. A small electrified rock hoist and a 5-hp. motor in the blacksmith shop were also handled by the turbo-generator set previously referred to.

The boiler plant for the rock crusher also handled a car spotter which spotted cars of rock on the scales, a car puller for moving cars from under the bin, and a rock hook for handling material in the gyratory primary crusher.

The preliminary tests looked so favorable



Crushing plant motor, the first of the supersynchronous type to be used to drive all the machinery of such a plant

Lime kilns. The picture was taken while changes in the method of feeding were being installed

that a more complete test was made and it was assured that a considerable saving could be made by electrification of the entire plant and the supplying of energy from the lines of the Public Service Co.

Plant Units

After a thorough survey it was decided to divide the installation into the following:

Rock crushing plant
New hydrating plant
Old hydrating plant
Air compressor
Water pumps
Derrick hoist
Car hoist
Rock hoist
Car spotter
Car puller
Rock hook
Blacksmith shop
Oil pumps
Rock drills
Screenings conveyor

The rock drills were pulled by gasoline engines at the time of the test and it was decided not to attempt to electrify them, as they were quite a distance from the main plant and the cost of a line extension to reach them would have been considerable.

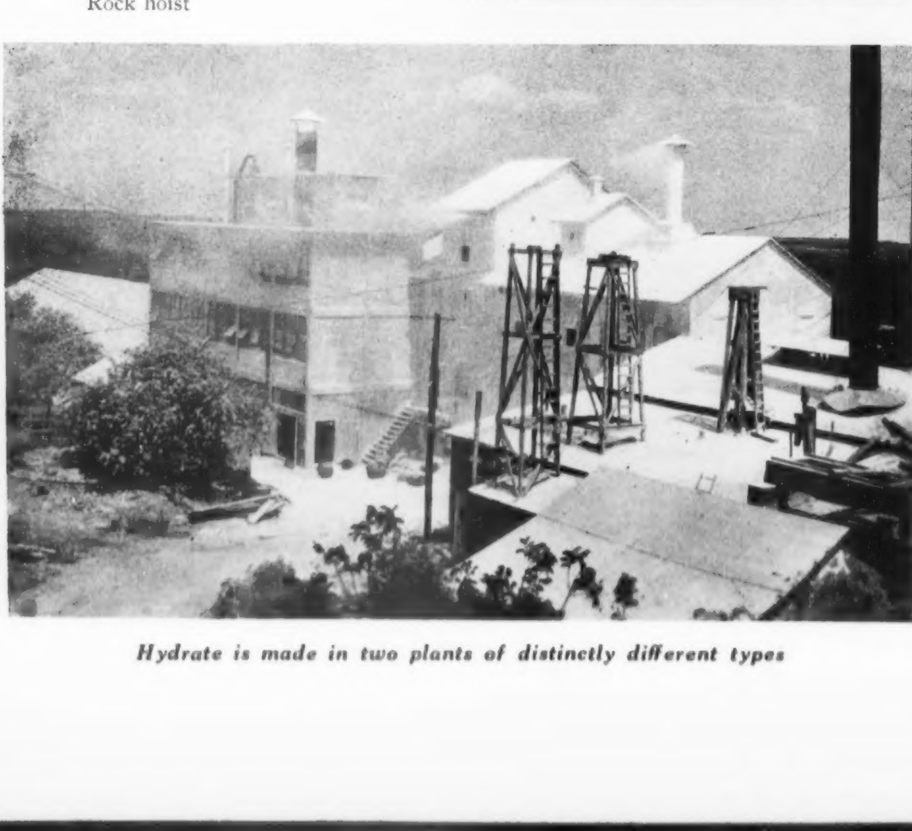
The screenings conveyor was originally pulled by the steam engine that handled the tail shaft, but much cable and clutch trouble was had and it was decided to electrify the unit.

Careful study of loads and operating conditions was made before making any specific recommendations. These were as follows:

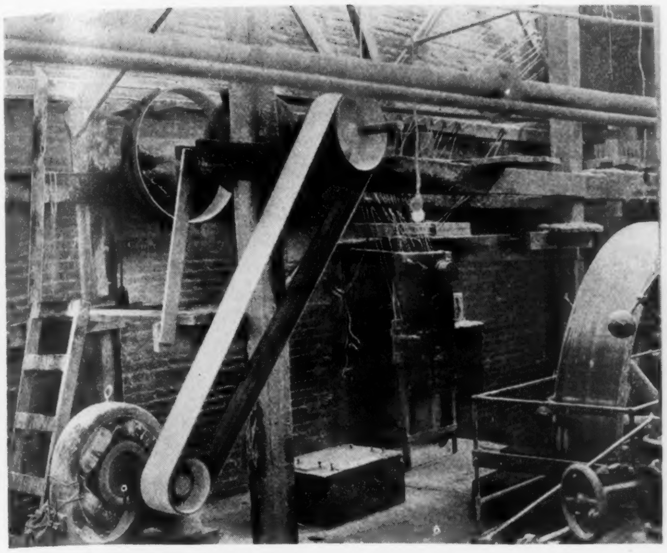
Only One Motor for Entire Crushing Plant

Rock Crushing Plant—This installation presented a more difficult problem than all of the rest because the load was varying and difficult to estimate, the severity of chokes only possible to surmise, and the possible motor adaptations many. Also it was necessary to correct the plant power factor by means of the rock crusher prime mover, a question of considerable economic importance. In all, seven possible schemes of motorization were considered. Of these, only two stood up as possibly desirable installations. One of these was the application of a 400-hp. slip-ring motor in such a manner that the tail shaft would be driven off the motor through "Texrope" or chain drive, and the primary shaft driven by a belt off the tail shaft. The other was the direct connection of a supersynchronous motor to the tail shaft, with the primary shaft driven by a belt off of the tail shaft. Of the two schemes, the latter was recommended because:

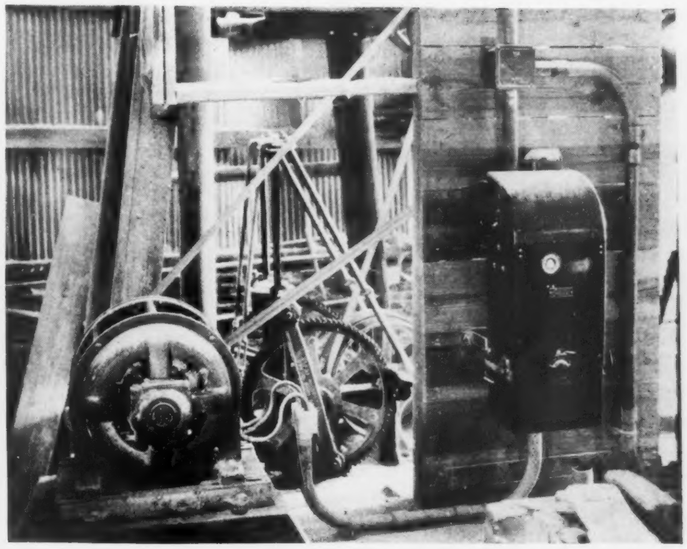
Drawing floor of the kiln house



Hydrate is made in two plants of distinctly different types



Direct current generator driven from motor in hydrating plant



Well pump motor and one of the three pumps

(1) It was the cheaper of the two by $1,578.50.

(2) It appeared that it would operate quite as satisfactorily as the other scheme.

In the comparison of these motors the question of power factor was equalized by the application of static condensers. The only real difference between them lay in their starting and pull-out torque, which compared as follows:

Motor	Starting Torque	Pull-out Torque
400-hp. slip-ring	265%	300%
400-hp. supersynchronous	190%	190%
Difference	75%	110%

The engineers believed, however, that the torques exerted by the supersynchronous were ample.

The actual recommendation was 400-hp., 2200-v., 3-phase, 60-cycle, 277-r.p.m. supersynchronous motor for direct connection to shaft.

It may be worth mentioning that this is the first installation of a supersynchronous motor to drive an entire rock crushing plant.

Where a number of crushers are to be driven there is a choice to be made between the use of individual motors for each crusher and the use of a single large motor to drive all of them. In using a single motor there is the advantage that a heavy feed to one crusher would not affect the large motor in the same degree that an individual motor drive would be affected.

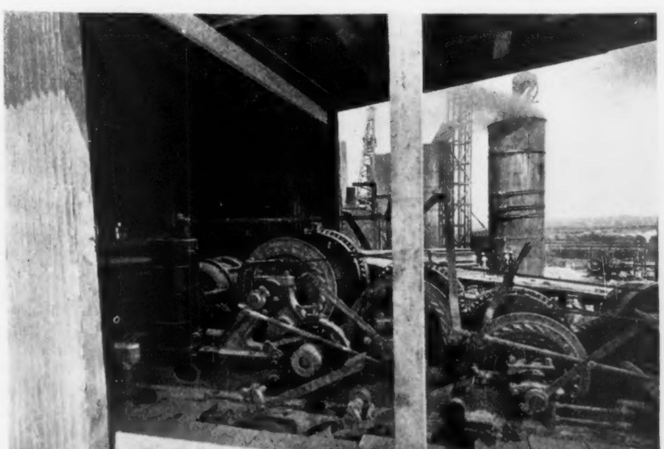
Motorizing Two Hydrating Plants

New Plant—This installation is a complete lime hydrating plant of 3½ tons hourly capacity, which takes in raw lime and turns out the finished product in bags. It is only equipped with one bagger and one pulverizer which can handle the entire plant capacity. Tests run on the existing motor drive showed a usage of 16.95 hp. when the hydrator and scalper were running and 69.5 hp. when the pulverizer, blower and bagger were running. This gave 86.45 hp. for the entire plant and some additional load was contemplated. The load was fairly constant but the starting was heavy. Bad dust conditions existed.

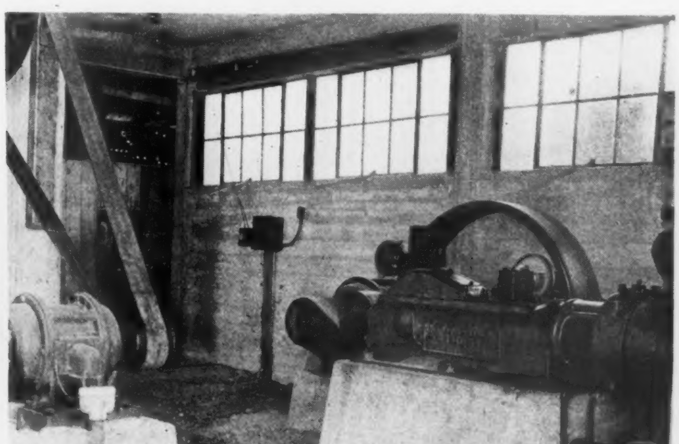
Recommendation—100-hp., 2300-v., 3-phase, 60-cycle, 900-r.p.m. slip-ring motor with 17x18-in. pulley, slide rails, complete starting equipment, and overload and undervoltage trips.

Old Plant—This installation is also a complete lime hydrating plant of 3½ tons hourly capacity, which turns out lime in 40-lb. sacks for domestic usage and 100-lb. sacks for export. An annex to the plant can also turn out approximately three tons of agricultural lime per hour. Although this plant has the same capacity as the new plant, it required more power, since it conveyed the entire feed of raw lime of both plants to the Sturtevant crusher, operated the crusher, and elevated the crushed lime to the point where it was divided, one half going to each plant.

Recommendation—125-hp., 2300-v., 3-phase, 60-cycle, 720-r.p.m., slip-ring motor with 21x18-in. pulley, slide rails, starting equipment, overload and undervoltage trips.



Three-drum hoist and motor for newly installed stiff-leg derrick



Machine shop motor and air compressor with short center belt drive

Air Compressor—It was decided to purchase a new air compressor, so the recommendations of the manufacturers were accepted as to its motorization.

Recommendation—60-hp., 2300-v., 3-phase, 60-cycle, 1200-r.p.m. synchronous motor with 12x12-in. pulley, slide rails, complete with starting equipment, and overload and undervoltage trips.

Above—Stacking screenings by a conveyor

Pumps—This installation consists of three pumps handling a total of 300 gal. a minute against a 280-ft. head. The theoretical horsepower required for the pumps is:

$$\text{Hp.} = \frac{300 \times 8.33 \times 200}{33{,}000} = 15.12$$

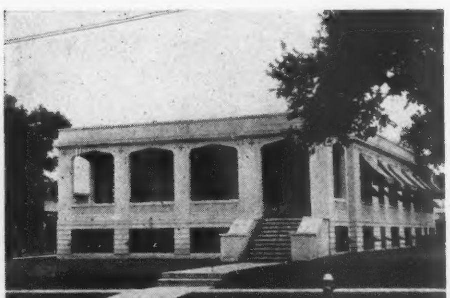
Power was being supplied by an 8x10-in. steam engine rated at 18 hp.

A 25-hp. motor could handle this load nicely, but some additional capacity was supplied to permit the pumping of another well.

Recommendation—40-hp., 220-v., 3-phase, 60-cycle, 900-r.p.m. squirrel cage motor with 12x10-in. pulley, slide rails, complete starting equipment and overload and undervoltage trips.

Motorizing Miscellaneous Units

Derrick Hoist and *Car Hoist*—It was decided to do away with these two installations and they were later replaced by a stiff leg steel derrick with a 60-hp. motor. This derrick will eventually load a single electrically operated kiln feed car. The details of the latter had not been fully worked out when recommendations were being made. [A Clyde Iron Works stiff-leg and three drum hoist, which is shown in the pictures, has since been installed.—Ed.]



Company office in New Braunfels

Rock Hoist—This installation consists of a hoist which returns small amounts of unburnt rock (core) to the top of the kilns. It operates very seldom.

Recommendation—10-hp., 220-v., 3-phase, 60-cycle, 1200-r.p.m. squirrel cage motor with 8x7-in. pulley, slide rails, complete starting equipment and overload and undervoltage trips.

Car Spotter—This installation consists of a double acting winch used to spot standard 50-ton railway cars of rock on the scales. It was originally powered with a 15-hp. steam engine which handled the load nicely.

Recommendation—15-hp., 220-v., 3-phase, 60-cycle, 1200-r.p.m., variable speed, crane type motor with reversing control, slide rails and overload and undervoltage trips.

Car Puller—This installation consists of a winch used for pulling rock-filled standard 50-ton cars from under the bins. The winch drum takes up 200 ft. of cable per minute. The grade is about 2%. The weight of a maximum car is about 170,000 lb. Foot-pounds required per 100 ft. of movement = 170,000 × 2 = 340,000. Theoretical horsepower required equals

$$\frac{340{,}000}{33{,}000 \times 2} = 51.4$$

Recommendation—50-hp., 220-v., 3-phase, 60-cycle, crane type, slip-ring motor with slide rails, complete starting equipment and overload and undervoltage trips.

Rock Hook—This installation consists of a hook which is used to loosen the rocks when they become jammed in the primary crusher. The drive is through a clutch to a drum. Originally a steam engine rated at 10 hp. supplied the necessary power.

Recommendation—10-hp., 220-v., 3-phase, 60-cycle, 1200-r.p.m., variable speed, crane type motor with reversing control, slide rails, overload and undervoltage trips and an electric brake for stopping the rotor.

Blacksmith Shop—This installation consists of the blacksmith shop.

Recommendation—10-hp., 200-v., 3-phase, 60-cycle, 900-r.p.m. squirrel cage motor with 8x7-in. pulley. This motor will also handle the load of a new drill that is contemplated.

Oil Pumps—This installation consists of two oil pumps that handle the fuel oil required by the kilns. They were originally driven by 2-hp. steam engines.

Recommendation—Small gear pumps direct connected to 2-hp. motors.

Screenings Conveyor—This installation consists of a belt conveyor which might handle 500 tons of screenings in 10 hours from the rock crusher to the storage pile, a haul of 495 ft. and a lift of 25 ft. This conveyor then was handling:

Below—Some of the employes houses

1,000,000 lb. in 10 hours
100,000 lb. in 1 hour
1,600 lb. in 1 minute

$$\text{Hp.} = \left(\frac{CT2}{1000} + \frac{TH}{1000}\right)$$

C = Power constant = .189
T = Load in tons of 2000 lb. per hour
H = Vertical height that material is lifted, feet
S = Belt speed, feet per minute
B = Width of belt
L = Length of conveyor between centers, feet

Assuming that this conveyor needs a capacity of 225 tons per hour—

$$\text{Hp.} = \left(\frac{.189 \times 225 \times 495}{1000}\right) + \left(\frac{225 \times 25}{1000}\right)$$

= 26.672 hp.

This conveyor has to operate under adverse conditions and therefore a motor larger than is theoretically required was recommended.

Recommendation—50-hp., 220-v., 3-phase, 60-cycle, 900-r.p.m., slip-ring motor with slide rails, complete starting equipment and overload and undervoltage trips.

Savings Made as Estimated

General Electric motors and accessories were installed in carrying out all of the above recommendations and the installation was completed about April 1. It has been operating in an entirely satisfactory manner ever since. The men quickly became familiar with the new equipment and like it.

Careful tests have checked almost exactly with the detailed calculations set forth in the report on the installation.

The original savings estimated by the power company amounted to $10,420 per year. These were net savings, an item of $3,380 having already been subtracted to cover interest, depreciation and taxes on the investment, due to electrification.

Natural Gas Firing at the Monolith Portland Cement Company

By Lee Holtz
Southern California Gas Co., California

THE Monolith Portland Cement Co. has recently made an interesting installation to the kilns at its Monolith, Calif., plant, by which they have been converted to gas-fired kilns using natural gas. Monolith is located about four miles east of the town of Tehachapi, Calif. To reach this plant, the Midway Gas Co. built a line consisting of 33.5 miles of 8⅝ in. O. D. and two miles of 6⅝ in. O. D. In passing over the Tehachapi range an extreme elevation of 4100 ft. was reached, the smaller size pipe being used at these altitudes.

The line was placed in service on Nov. 17, 1926, after a record installation of nine weeks. It is built for a capacity of about 10,000,000 cu. ft. a day, under average pressures.

The author, assistant superintendent of distribution, Southern California Gas Co., assisted in the installation and testing of the giant burners at the Monolith plant.

While the burning of cement clinker with natural gas is comparatively new on the Pacific Coast, it is by no means a first experiment in the cement business; natural gas was used quite extensively in Kansas and Oklahoma 12 to 15 years ago. At the present time, in these states, gas is used in connection with pulverized coal.

The Monolith plant uses the wet process, three 7½x9½x200 ft. and one 10x11x200 ft. kilns being in place. These kilns were formerly fired by oil. Each of the three 9½ ft. kilns are equipped with two 17½ in. Kirkwood burners weighing approximately 900 lb. each and capable of delivering approximately 800 cu. ft. of gas per minute at one pound pressure. The burners are mounted on steel carriages, are set two to the kiln, and are adjustable.

The large kiln is equipped in exactly the same manner as the three smaller kilns, except that the burners are 23½ in. in diameter and weigh approximately 1200 lb. each, with a delivering capacity of 1200 cu. ft. per minute at one pound of pressure.

The "Kirkwood" burner consists of an outer and inner casing, forming a circular space into which space a large number of small pipes having fine holes are introduced. An opening is provided for introducing the gas into the circular space from which the gas escapes through the small pipes and comes out of the small openings in a number of fine jets. Air is blown through the burner and produces a proper mixture of gas and air for combustion. The spiral arrangement of the pipes sends the gas into the air with a whirling motion which gives a thorough mixture of gas and air.

An air blast of from five to eight inches of water pressure is introduced at the back of the burner and is regulated by means of a butterfly valve located approximately 10 ft. from the burners in the air duct from fan.

The three small kilns are equipped with No. 80 Sturtevant Turbovane fans capable of delivering 18,500 cu. ft. of air per minute at five inches water pressure. Each of these fans is driven by a 20.6 hp. direct connected electric motor at 1460 r.p.m.

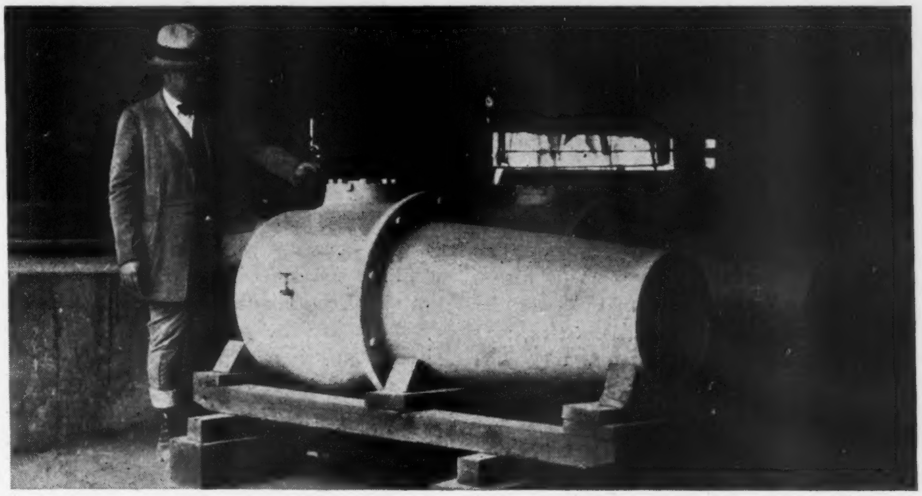
The large kiln is equipped with a No. 85 Sturtevant Turbovane fan capable of delivering 33,000 cu. ft. of air per minute at five inches water pressure and is driven by a 36 hp. direct connected electric motor at a speed of 1460 r.p.m.

The matter of constant pressure and even gas supply is one of considerable importance. The operation must be dependable owing to the fact that kiln shut-downs are very costly.

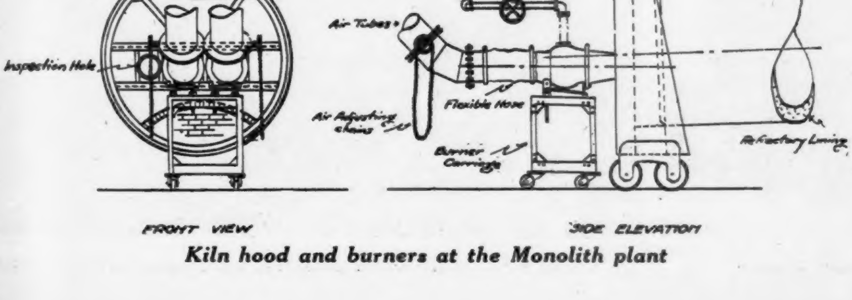
To insure the most dependable service possible, two eight-inch soft seat lever type regulators are placed in parallel at the meter set-up, a short distance from the mill, and two near the kiln room. However, only one regulator of each installation is in service at any time, the other one acting as an auxiliary adjusted to perform instantaneous service in case the regulator in use fails to function properly. The fact was also considered that the plant location being approximately 4000 ft. above sea level, cold weather is experienced during the winter months, and due to the rapid expansion of gas when flowing at a rate of 325,000 cu. ft. an hour with an initial pressure of 125 lb. per sq. in., there may be a tendency for a regulator to freeze and stick.

The pressure is reduced twice before entering the kiln room header. At the meter there is a reduction from 125 lb. to 20 lb., and at the kiln room the reduction is from 20 lb. to 6.5 lb. The header runs the full length of the kiln room and is 18 in. in diameter. A header of this dimension is considered very essential from an operating standpoint as it not only acts as a reservoir back of the burners but maintains a pressure absolutely constant when a kiln is shut down.

All kilns are equipped with sub-orifice meters for measuring each kiln's daily consumption. Pressures on the burners are also recorded for the operator's control. It is found that when gas fuel is used for burning, clinker rings are formed less frequently than when oil is used as fuel.



Lee Holtz standing beside one of the giant gas burners



Kiln hood and burners at the Monolith plant

*Reprinted in abstract by special permission from *Western Gas*, Los Angeles, Calif.

Gravel Plant Crushing and Screening Equipment and Design

Part I—Types of Rotary Screens

By Hugo W. Weimer
Consulting Engineer, Milwaukee, Wis.

THE operator of a sand and gravel washing and screening plant is confronted with practically every problem that the stone quarry man has to contend with, and in addition there are other problems owing to added operations, such a washing, scrubbing and dewatering of material. While some of the screening equipment illustrated with this article was designed and patented over thirty-five years ago and with special reference to gravel screening, it is nevertheless a fact that the man who developed and erected a gravel plant up to about fifteen years ago was a pioneer in the field and did not have a multitude of plants such as exist today to look to for a criterion to go by, and he was not able to profit by the experience of many others.

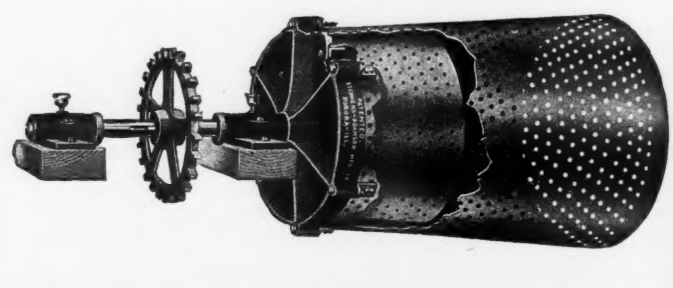
The use of properly washed and screened gravel in construction work of various kinds has opened up a market that could not possibly have been taken care of entirely by limestone, granite and trap rock crushing plants.

There are, however, some commercial sand and gravel plants, and certainly many smaller plants, which are producing material that the industry as a whole cannot be proud of. This condition is due, in some cases, to the fact that the deposit contains a large percentage of foreign material, such as clay, which cannot be washed out sufficiently on a reasonable commercial basis. Some plants do no stripping whatever and depend on using an excess amount of water to wash out all foreign matter. In some cases this is certainly not the best practice if a good clean product is required. Some of the existing plants have difficulty with the quality of their product when operated to what is supposed to be the normal capacity of the plant. This condition indicates that some item of the equipment cannot function properly at its rated capacity, or, while it may have been sufficient at one time, changes in the deposit may have had some effect.

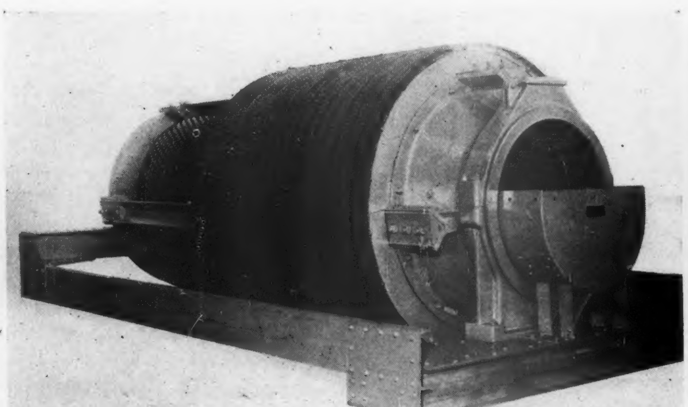
To illustrate and discuss the design of various equipment and later the assembly of complete plants, the writer is submitting this as the first of a series of articles dealing with the sand and gravel industry.

No one is more envious of his good reputation as a producer of good clean material than the average gravel plant operator, and while rigid specifications and close inspection may have forced the issue somewhat, it is worth while to note that in the state of Wisconsin, for instance, the rock products operators have formed an association and have employed an efficient secretary who with his knowledge and practical experience is able to find the root of many of their plant troubles and recommend a remedy. This has done a great deal to make the product of the various plants come up to the highest standard.

Screen with entrance and discharge at same end with interior shaft



Screen with entrance and discharge at same end but without interior shaft

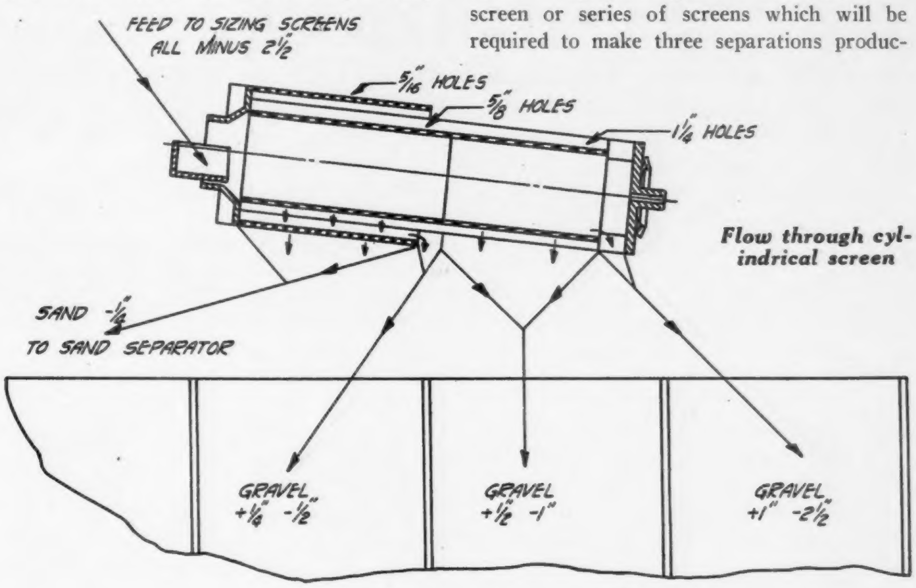


One of many types of cylindrical jacketed screens

Conical screens mounted in series on single inclined shaft

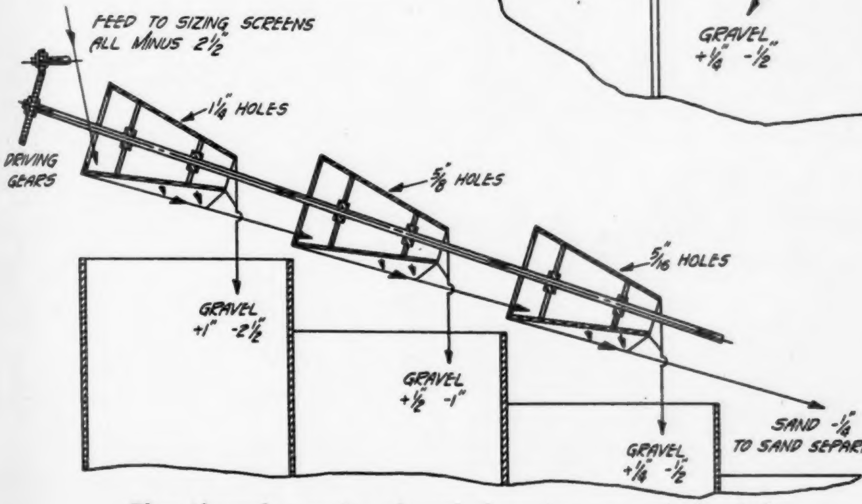
The writer will make no attempt to illustrate and describe the various items of equipment in their proper sequence, but will take various phases of sand and gravel equipment at random. Screens in this industry are not only required to do the actual sizing of material, but, furthermore, do washing and in some cases scrubbing of the material. It follows that one of the most important items of equipment is the screening unit. Two of the most popular types of rotary screens at the present time are the conical and the cylindrical designs, and the illustrations herewith show that there are three common designs of conical screens which are now in use. Each one of the four types of screening equipment illustrated will produce well-screened material, and it is not the province of the writer, nor is it his intention, to recommend any one design over the other.

The oldest type of conical screen construction is of the through shaft design and is claimed by some not only to be superior to the cylindrical screen, but to the other types of conical screens, because there is no undesirable upward thrust on the support bearings as is claimed to be the case with the overhung type. There are some operators who prefer the rotary conical screen of the overhung or cantilever type, which is similar to the conical screen previously mentioned, with the exception of the location of the supporting and driving shaft. The unique arrangement of mounting a series of conical screens on a continuous shaft is successfully used in many installations. The rotary cylindrical screen may need an introduction to some sand and gravel operators, but the design and use of the same is an old story in connection with not only the stone crushing industry, but the mining industry as well. It is claimed for the cylindrical screen that less head room is required and, consequently, there is a saving in the cost of the bins and screen supports. To illustrate how these various types of rotary screens function the writer has assumed a hypothetical condition whereby material that has all been reduced to minus 2½-in. ring size is delivered to a screen or series of screens which will be required to make three separations producing sand which is all minus ¼-in., gravel ¼-in. to ½-in., ½-in. to 1-in. and 1-in. to 2½-in. We will assume that no scrubbing of material is required, but merely sizing and washing.

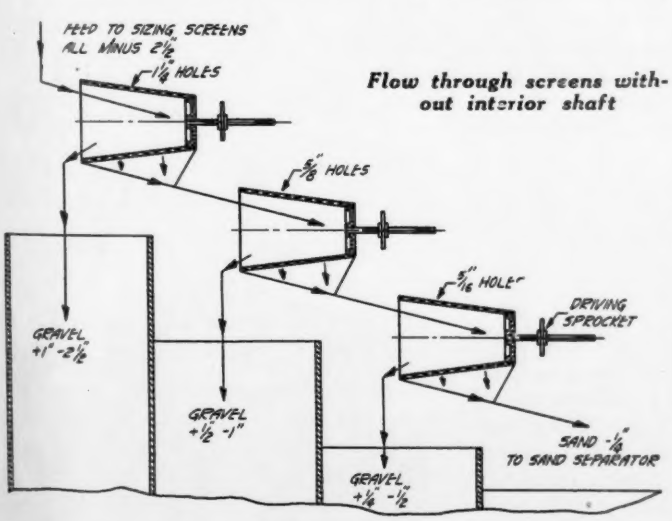


Flow through cylindrical screen

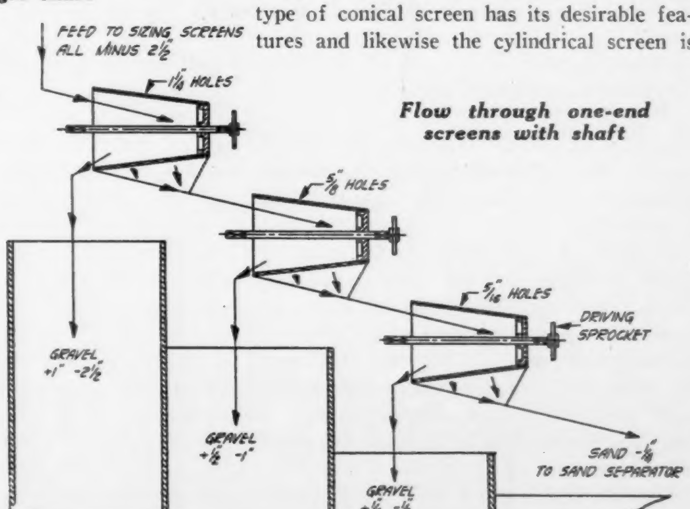
It will be noted that with all the conical screen arrangements the largest size product is the first finished material discharged by the screens and that the sand and water passes on down to and through the last screen. With the rotary cylindrical screen the sand is the first product discharged from the screen, with the largest size of gravel being discharged at the farthest end. Each type of conical screen has its desirable features and likewise the cylindrical screen is meeting with a great deal of favor in the sand and gravel industry. The writer has endeavored to illustrate all of the popular types of rotary screens being used today and to show the screening principle of each design, so that the operator of an existing plant may become familiar with screens of other types than his own and the prospective gravel man or student may know of all types.



Flow through a series of conical screens on a single shaft



Flow through screens without interior shaft



Flow through one-end screens with shaft

Dewatering Discharge of Pump Dredge

Wolf River Sand Co. Uses Method That Avoids the Cost of Stripping the Deposit

HOW to dewater the discharge of a dredge pump and handle the solids is one of the problems which has exercised the minds of producers about as much as any in the sand and gravel industry. The discharge comes from the pump with 15% of solids and 85% of water. This means that an enormous weight of water has to be lifted to the screens or otherwise disposed of. It also means that the unusual screening arrangements have to be made, for the regulation cylindrical or conical screens are not adapted to receive the material with so much water. Some form of dewatering (or some different method of screening) has therefore to be adopted.

There are several ways of dewatering a dredge discharge and the Wolf River Sand Co. of Memphis, Tenn., has tried two of them. The first method tried was that of pumping to a point in the dredge pond near the plant and then digging out the settled sand and gravel with a cableway excavator. This was described in Rock Products about three years ago.

This method worked well, as it works well in other places. But it had one defect, that of not giving the material a sufficient preliminary washing. The Wolf River deposit has a considerable overburden of clay and the operators of the plant believe that it is cheaper to wash out this clay than it is to strip the deposit. In pumping to the same spot in the pond it was inevitable that some clay would settle with the material. If there had been a current to carry this clay away from the plant, as there would be in a river or a tidal inlet, the objection to the method would not be present.

After deciding to abandon the dragline the owners of the plant consulted the engineering department of the Stephens-Adamson Manufacturing Co., who suggested the method now in use. It was installed about a year before the notes for this article were made, and after this year's experience the company is quite satisfied that it is the method best adapted to their conditions, and there is no intentions of changing it.

This shows the dredge pumping to one sump while the sump filled the day before is emptied by the derrick

The dredge has a 12-in. Ellis pump with a 200-hp. Westinghouse motor, direct connected. This does not give a very long radius of operation or permit much static head on the pump and the motor will be changed for one of greater power when its economical limit has been reached. But as it has only to lift 12 to 15 ft. with the dewatering arrangement used, the present power will command a considerable radius, as may be judged from the worked out area that shows in the picture. It is the intention to carry the working around the plant and dewatering sumps leaving these on a peninsula.

The dredge pumps to either of two circular sumps. Both are 60 ft. in diameter and 24 ft. deep. This would give them a full capacity of 2512 cu. yd. each, but they are not used to full capacity. About 1000 yd. is excavated from each after filling, the remainder of the load being left to absorb the drainage.

The sumps are built with earth banks and lined inside with heavy planking which is spiked to posts. The construction is pretty clearly shown in the pictures. The dredge pumps into one sump while the other is being emptied and the excess water is run off through an outlet which is opposite to the point where the pump discharges. The water goes into a "well" with a gate built up with slats as the material rises.

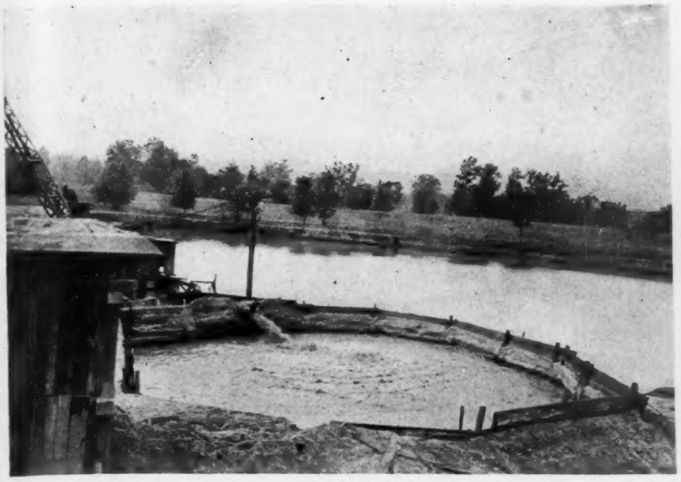
The overflow at the well is kept so that the material shows above the water as the sump fills. This gives a flow of water across the sump which washes away the clay from the sand and gravel exposed.

When the sump is filled the material in it is allowed to drain over night and the water drains down 10 to 12 ft. below the surface, with only the water that is held by capillarity remaining. In the morning the derrick, which has emptied the other sump the day before, begins work on this sump and empties it in time for the next day's run.

The derrick used was made by the American Hoist and Derrick Co. and it is of steel with a 60-ft. boom which enables it to reach across the sump. The bucket used is a 2-yd. Williams and the hoist has three drums and was made by the makers of the derrick. The bucket is discharged into a 20-ton hopper which is placed over the 250-ft. conveyor belt 24-in. wide that carries the sand to the washing and screening plant. It is of Stephens-Adamson design and has Gilbert screens and sand boxes of the company's own design and make and has been described in previous issues of Rock Products.

The belt was originally run at 300 ft. per minute, but it has been found better to run it faster to prevent any drips coming off the end of the belt. Usually the sand is so well drained that there are no drips, but in hot weather, or when the bucket is digging from the bottom of the sump, the sand con-

Hopper over plant belt



Emptying the drained sump. Note top of well for running off water near the house

Filling a sump. The excess water and clay runs off at a well opposite pump discharge

tains a larger proportion of water.

The sand is fairly clean as it is excavated by the bucket, because almost all the clay has been taken off with the overflow of the sump. It would pass some specifications for cleanliness. But after it has been through the washing plant it is exceptionally clean, with the clay content down to 1% or less. As the sand is almost pure silica and well graded, its appearance is a powerful sales argument and it commands a high reputation.

The sand does not contain much gravel. If it did it is doubtful if the dewatering system would work as well, as there would be a tendency for the gravel to separate from the sand and remain at the pump discharge. This could be prevented by having the pump discharge in the center (so that the gravel would "cone up") and taking off the overflow through four wells instead of one. Another more usual method would be to separate the sand and gravel roughly by a screen which received the pump discharge and then to settle the sand in the sump. The gravel could be handled by an elevator to the belt.

A comparison of costs would show that it is cheaper to pump directly to the upper part of the plant than it is to dewater and excavate with a bucket and convey to the plant with a belt. But the fact that the cost of stripping is avoided overbalances this. There is also the gain in the quality of the material, due to the better washing, which has a real market value.

The office of the Wolf River Sand Co. is in the Falls building in Memphis. V. A. Cordes is president, James H. Griffith is vice-president in charge of operation and W. A. Bridewell is secretary. W. L. Follet is superintendent at the plant.

Finishing Hydrated Lime

THE Finishing Lime Association of Ohio has issued a very handsomely printed pamphlet (Bulletin 400) giving the standard specifications for finishing lime plaster. It may be had from the office of the Association, 240 Huron Street, Toledo, Ohio.

Los Angeles Producers Win First Round in Municipal Rock Plant Fight

THE project to install a municipal rock, sand and gravel plant in Los Angeles, Calif., has been put to sleep (temporarily at least) by the action of the Southern California Rock Products Association. E. Earl Glass, the engineer of the association, prepared a splendid report on the project in which he showed plainly that the only persons to benefit by the project were the promoters who had land and machinery to sell.

It is somewhat extraordinary that the proposal for a municipal plant in Los Angeles could have been seriously considered in the light of experiences of others in similar enterprises. Mr. Glass' report says:

> Every state has adopted laws to restrict this form of unfair competition against business enterprise and to protect the taxpayers from ill-advised municipal undertakings. The city of Pasadena has just disposed of its rock plant to comply with the law and end a similar costly experiment in the manufacture of rock products, as have Kern county and many others. The county of Los Angeles learned long ago that it was paying more to make its rock at its own plant than it could be bought for from the producers, and promptly abandoned the county crushers. The city of Los Angeles has had numerous unpleasant experiences with this day labor hobby in various forms, one of which was a municipal cement plant. The city has just sold more than a million dollars' worth of depreciated equipment and supplies at the harbor for what it could get at auction. This is a heavy loss, indeed, if it has not taught a lesson that will protect the city from repetion of such experiences. We can furnish the board with an impressive file of references to spectacular failures of municipal ventures in business.

The shortsightedness of those who favor a municipal plant is shown by the fact that the commercial plants near the city pay over $1,000,000 in taxes yearly, while the municipal plant, which would pay no taxes, is estimated to save no more than 8/10 of a cent per ton. And this narrow margin of estimated saving could of course be wiped out in a dozen different ways. As Mr. Glass says:

"As poor a business man as I must admit the average rock producer has proved himself, I doubt if one could be found who would fall for such a deal as is here offered to the city."

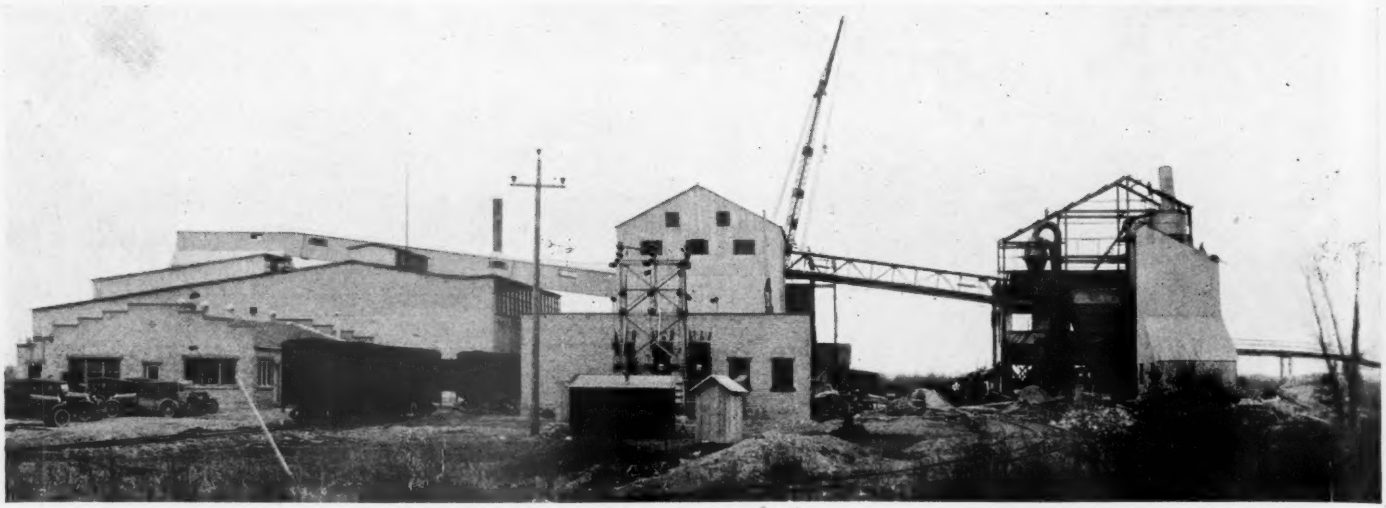
As a matter of fact the city's own report shows that it would cost more to produce rock than it is paying for rock at present, for as Mr. Glass points out:

> It is doubtful in any other article manufactured to a strict specification can be handled on so narrow a margin as provided in a price of 90c per ton for washed and screened crushed rock f.o.b. cars at the plant. If the city is casting about for means of augmenting its regular sources of revenue, we most heartily do not recommend the rock business. The report we will refer to as No. 1, obtained from your board, uses 90c per ton as the purchase or contract price of crushed rock f.o.b. cars at Kincaid. From the second report it appears that the average contract price to the city of Los Angeles for several years has been 86c per ton or less, f.o.b. cars at Kincaid.

The full analysis of the report which favored a municipal plant is an interesting exposition of how such projects are promoted. Incidental expenses that must be borne are omitted altogether. The cost of trucking from one plant, and that a distant one, as compared with trucking from 30 plants and distributing bunkers, so placed as to be near all localities, is not even mentioned. Sand is to be discarded at the plant, but the expense of wasting it is not allowed for. The cost of unbalanced production (since the city can use only a limited part of the production) has not been taken into consideration, and finally there is the first cost of the plant itself. It was estimated that this would be $650,000. Mr. Glass says:

> Plants of this capacity in good condition are available for a fraction of this figure, and if the city insists on buying a rock plant for someone to play with, I can stampede the board with offers of really attractive propositions for $300,000 or less, naming your own terms.

Under the searchlight of such criticism the benefits of a municipal plant dwindled until it became apparent that the city would face substantial and increasing losses if the plan were to be carried out.



View of the National City plant during construction. At the left is the mixing and storage addition of the board plant; center, the calcining building, and right, the mill building

New Wallboard and Mixed Plaster Plants at National City, Michigan

National Gypsum Co. No. 2 Plant Presents Some Interesting Features of Design and Operation

By John J. Landy
Assistant Editor, Rock Products

IT is scarcely two years since the National Gypsum Co. was organized, yet the company has become an important factor in the gypsum wallboard industry. It operates two of the largest wall board units in the world, one at Clarence, N. Y., and the other recently put into production at National City, Mich. The combined output of these two plants (after the National City operation gets well under way) is estimated at about 200,000,000 ft. of board per year—equivalent to about *one-fifth* of all the wall board produced in the United States during the past year.

While the general operating scheme of the National City plant is the same as that at Clarence, the quarrying system and plant layout are quite different. The location of the different buildings seem to provide for a greater continuity of operation and easier supervision. The double loading track arrangement, placed on either side of the National City board plant, allows for easier expansion than the double track which runs on only one side of the Clarence mill.

Looking down into the stripped portion of the quarry

The boiler house is also conveniently placed at National City—along and to one side of the board mill. The new board plant is of rectangular design, 704 ft. long and 74 ft. wide, the only break being at one end, where the stucco mixing department is located—an "L" running off the main building. It has no fan house, all the equipment being bunched centrally, between the dryer and board machine.

At Clarence, N. Y., the nature of the deposit makes it possible to use only one way of rock recovery—mining by the room and pillar system. This is common practice in many gypsum operations, so a description will be foregone. At National City, however, the deposit will be worked by a rather unusual if not altogether unique method. In brief, a combination of open quarrying and mining will be employed. This will be explained in detail along with the somewhat different stripping operation further in this article.

Deposit

All the gypsum in Michigan is rock gypsum and of high purity. The chief areas of importance are in the vicinity of Grand Rapids and the so-called Alabaster region.

The National Gypsum Co.'s deposits are in the latter region, 17 miles from East Tawas. The country in that section was one of the first to be worked for gypsum and has had a varied history. In 1837 gypsum deposits were first made known and several outcrops profitably worked for land plaster. A quarry was opened at Alabaster, eight miles from Emery Junction (now National City) in 1862 which later became the nucleus for the present U. S. Gypsum Co. and is now being operated on a large scale by that company.

The property owned by the National company comprises about 1000 acres upon which sufficient prospecting has been done to indicate that a good supply of high-grade rock is present. Test borings indicate that gypsum beds from 5 to 30 ft. deep are on the property. These are overlaid by an average overburden of 8 ft. of clayey loam of glacial drift origin. The beds themselves belong to the Grand Rapids group of the Upper Mississippian series, which puts them in the carboniferous system. Their formation is somewhat obscure, no reliable geological data being obtainable.

The rock itself is almost a pure white, crystalline, with infrequent hair seams of shale. A bed of shale underlies the gypsum stratum. Some recent analyses of the rock indicates a high gypsum content, with a combined total of less than 1% of silica, alumina and magnesite. Calcination tests made on the rock are said to have produced a good white stucco with excellent setting and hardening requisites.

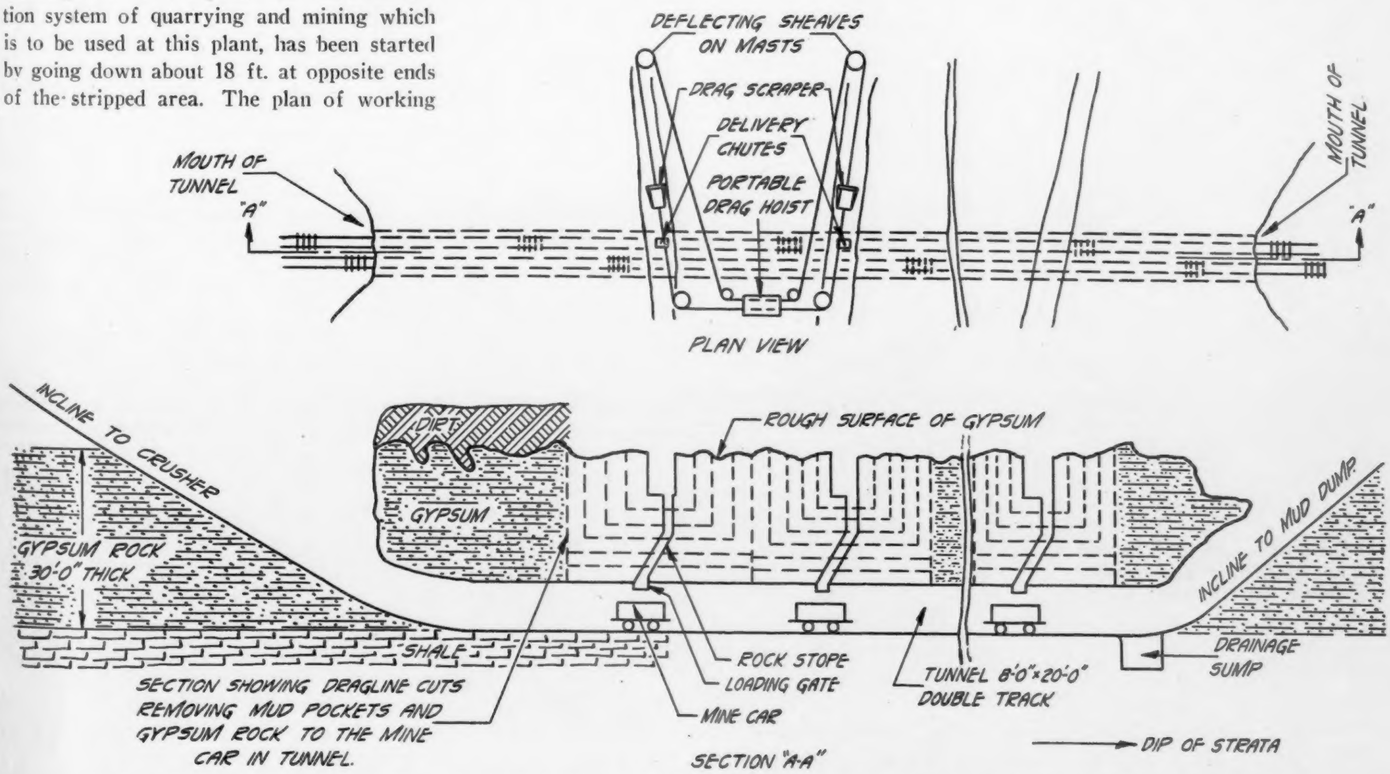
Quarry Operations

About 1½ acres of the deposit have been stripped. This area is close to the crusher building. The development of the combination system of quarrying and mining which is to be used at this plant, has been started by going down about 18 ft. at opposite ends of the stripped area. The plan of working

One end of the tunnel which is to be driven under the deposit in accordance with the rock recovery system

is as follows: A double track tunnel will be driven under the gypsum bed, in which 2-yd. mine cars will run. At various positions directly over the tracks, stopes will be driven upward through the gypsum bed, to the surface. The overburden will be stripped, using a portable drag-scraper with open bucket, discharging into the stopes under which mine cars are placed. A gate at the bottom of the stope will be used to regulate the amount of material passing to the cars, which after loading will be hauled to the dump by cable. Any surface dirt remaining will be washed by a small monitor to enlarged natural water courses running to a sump at the tunnel bottom, from which a mine pump removes the water at about the same rate it enters.

The now thoroughly cleaned stone will be quarried in the usual manner, small holes being put down vertically and loaded with small charges and fired. The broken stone will be carried by the same drag-scraper used for stripping to the open stopes and dropped down the shaft to the waiting mine cars, which are then hauled to the crusher. It is planned to work individual sections in this manner, so that in time the stripping from one section may be used as a fill on a worked out area. The accompany-



Section through the deposit illustrating the system of rock recovery resembling the "glory-holes" of metal mines

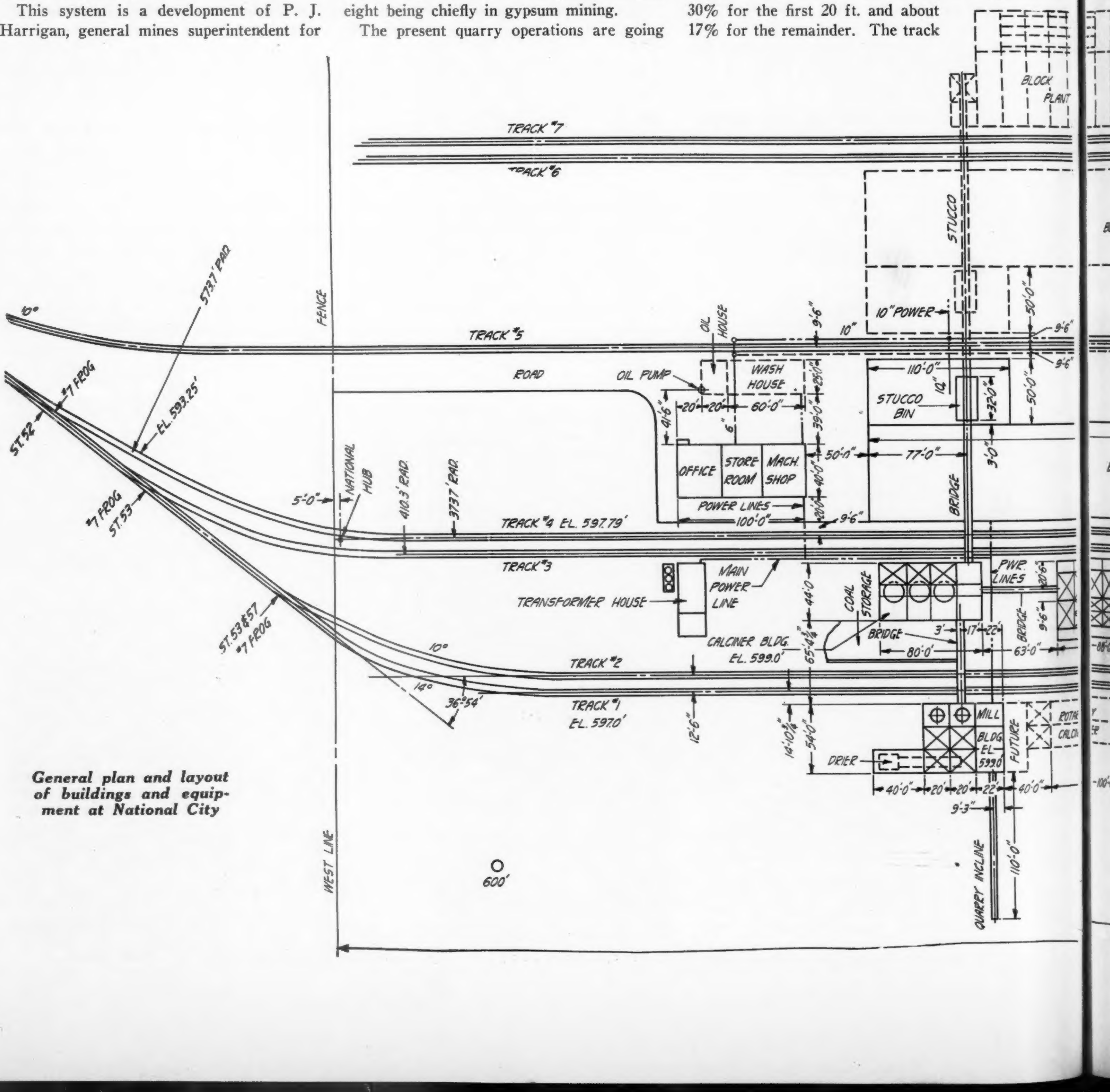
Showing the method of opening the quarry preliminary to future development

ing illustration shows in detail the operation scheme to be followed.

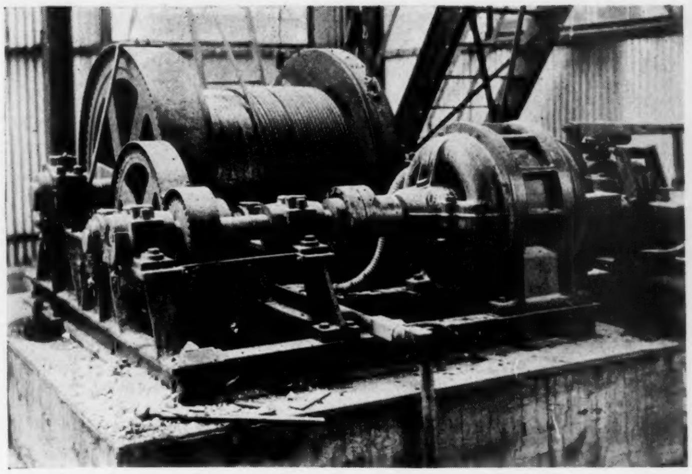
This system is a development of P. J. Harrigan, general mines superintendent for the company, who has been engaged in various mining activities for 37 years, the past eight being chiefly in gypsum mining.

The present quarry operations are going forward with the subsequent development scheme in view. An open cut is being made, the removed rock being loaded by hand on to 2-yd. Koppel steel cars and hauled up the incline to the crusher house. An Ingersoll-Rand X-22 with 1-in. drill is used to sink the holes to a depth of about 6 feet. They are then shot with 20 and 40% du Pont dynamite. Extra large pieces after shooting are broken down by a pneumatic "concrete breaker," a somewhat unusual procedure which seems to work out rather well. The same tool is used to further loosen the rock so as to facilitate the hand-loading.

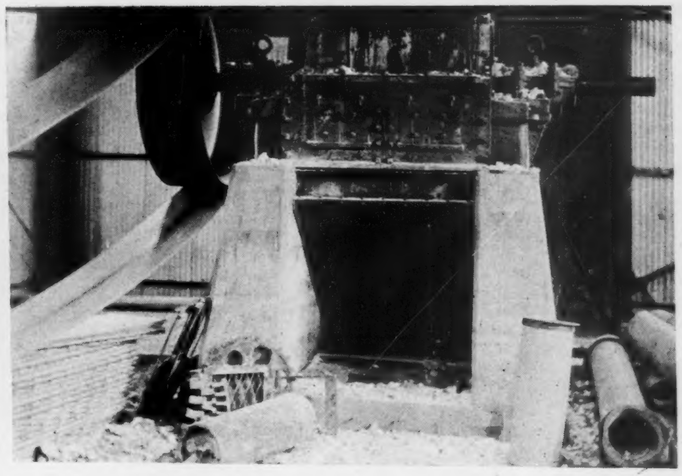
The incline from the crusher house to the pit is at present about 110 ft. long, but will be extended as the working progresses away from the plant. The lower end has a frog switch, two tracks running to the open cut permitting the loading of two cars while the others are being hauled to the crusher. The grade of the incline to the crusher is about 30% for the first 20 ft. and about 17% for the remainder. The track



General plan and layout of buildings and equipment at National City



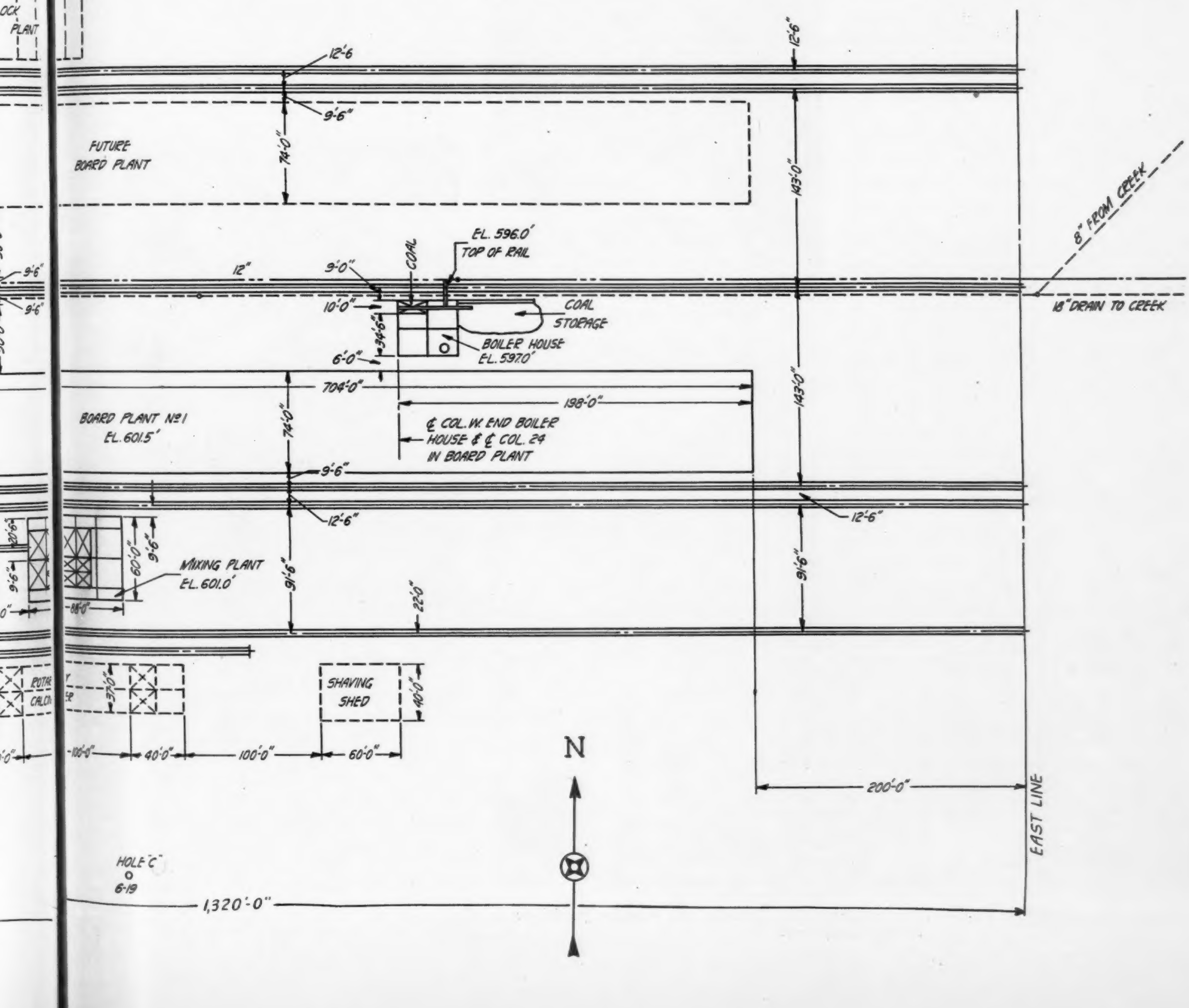
Remote controlled hoist

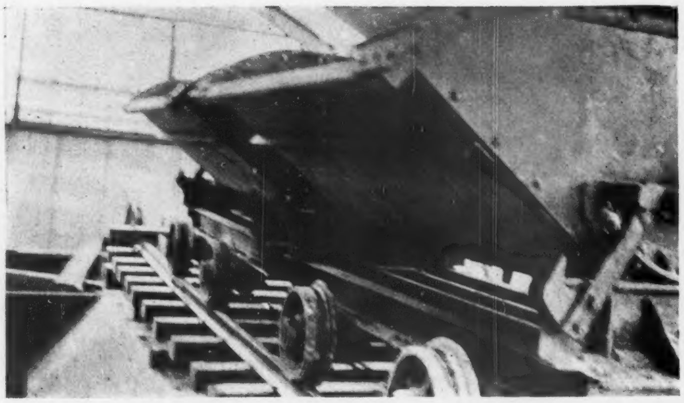


Rigid-hammer crusher for primary crushing

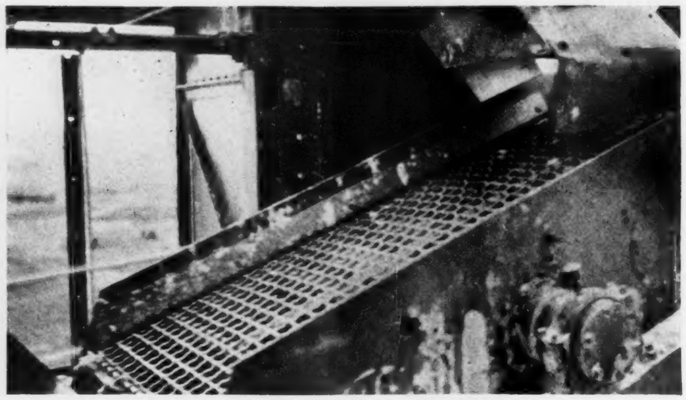
is 36-in. gage with 30-lb. rails placed on heavy wooden sleepers. The loaded cars are drawn up the incline by a single-drum, 3-speed reversible remote controlled hoist, operated by a 50-hp., 440-v., 696 r.p.m. induction motor. The hoist furnished by the Vulcan Iron Works is equipped with solenoid brake and hand brake. Leschen "Red Strand" 1-in. wire rope is used with the hoist.

The cars are dumped to a Jeffrey apron conveyor feeder operated by a 5-hp., 440-v. electric motor, discharging to a 42 x 48-in. Jeffrey rigid hammer crusher, belt-driven by a 100-hp., 440-v., 875 r.p.m. induction motor.





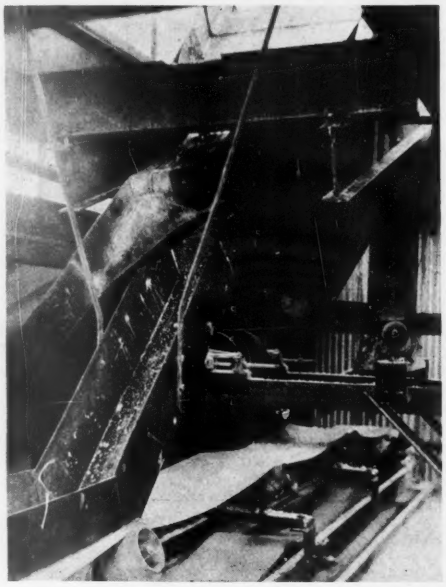
Cars dumping into apron feeder



Shaking screen at top of building

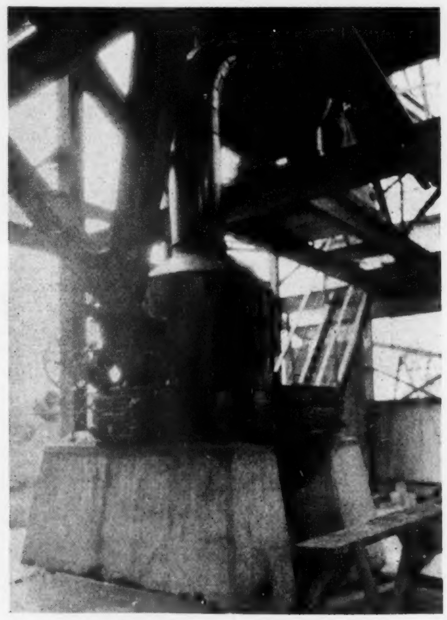
This crusher has a capacity of 125 tons per hour reducing to 1¼-in. and under. The controls for the hoist, apron feeder, crusher and crusher discharge are located on a landing near where the cars are dumped and are so placed that one man, who is in full view of all the equipment, can take care of these operations.

The crushed rock drops to the boot of a chain and bucket elevator which carries it to the top of the building, where it passes over a Niagara shaking screen of the double deck type. The elevator is driven by a 15-hp., 440-v., 865 r.p.m. electric motor and the screen operated by a 5-hp., 440-v., 865 r.p.m. electric motor. The upper deck wire cloth has 1½-in. square opening, and the lower, ½-in. Arrangement through chutes is provided at the screen to remove the various sizes. The oversize (1½-in. and up) is returned to the hammer mill; the material passing 1½-in. and retained on the ½-in. screen drops on a belt conveyor and is discharged through a chute either to storage or cars for shipping. This is also delivered as required to the storage bins above the rotary dryer. The material, ½-in. and under, is passed by belt conveyor to a large parabolic-bottom steel bin of about 500-ton capacity, located over the rotary rock dryer. The conveyor is an 18-in. rubber belt, 50 ft. on centers, driven by a 5-hp. electric motor. Chutes and conveyors carrying sized material from the shaking screen are so arranged that different sizes may be directed to bins, storage or cars, as desired.

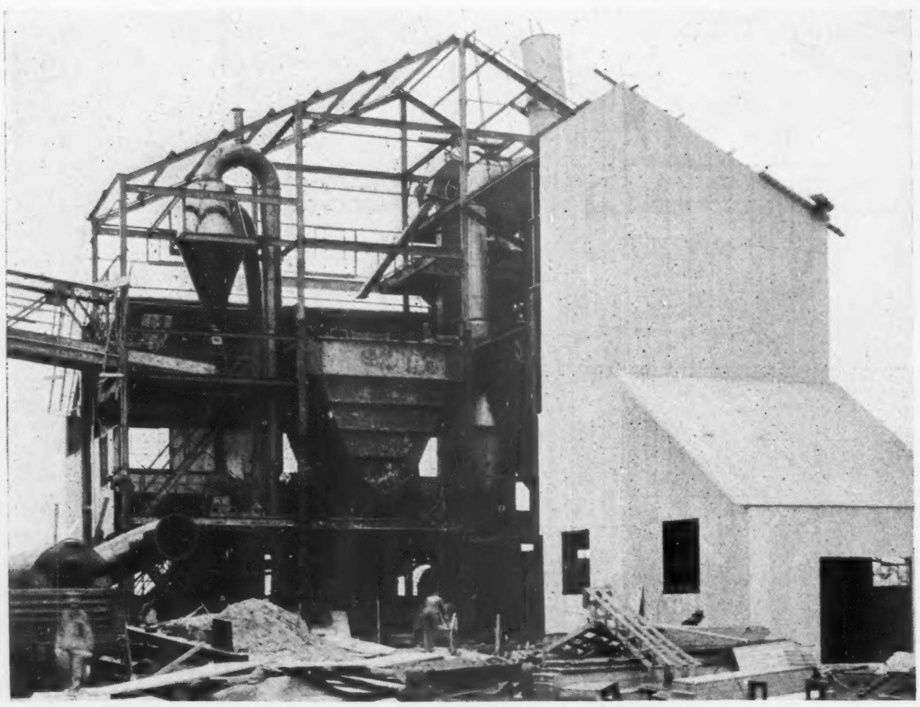


Chuting arrangement under the screen to remove various sizes

Along the bottom of the parabolic bin located over and on center with the rock dryer are six bin gates, each equipped with a reciprocating rock feeder of the automatic type, which continuously feed rock from the bin to a conveyor belt discharging to the rotary rock dryer. The dryer, made by Vulcan Iron Works, is 6x45 ft. and inclined slightly towards the discharge end, rotating on two steel bands at each end supported on trunnions. The dryer drive is a 25-hp., 440-v., 840 r.p.m. slip-ring motor through a Huron Industries spur-gear speed reducer (1:6.3 ratio), the connection being through an Ajax coupling. Coke is used to



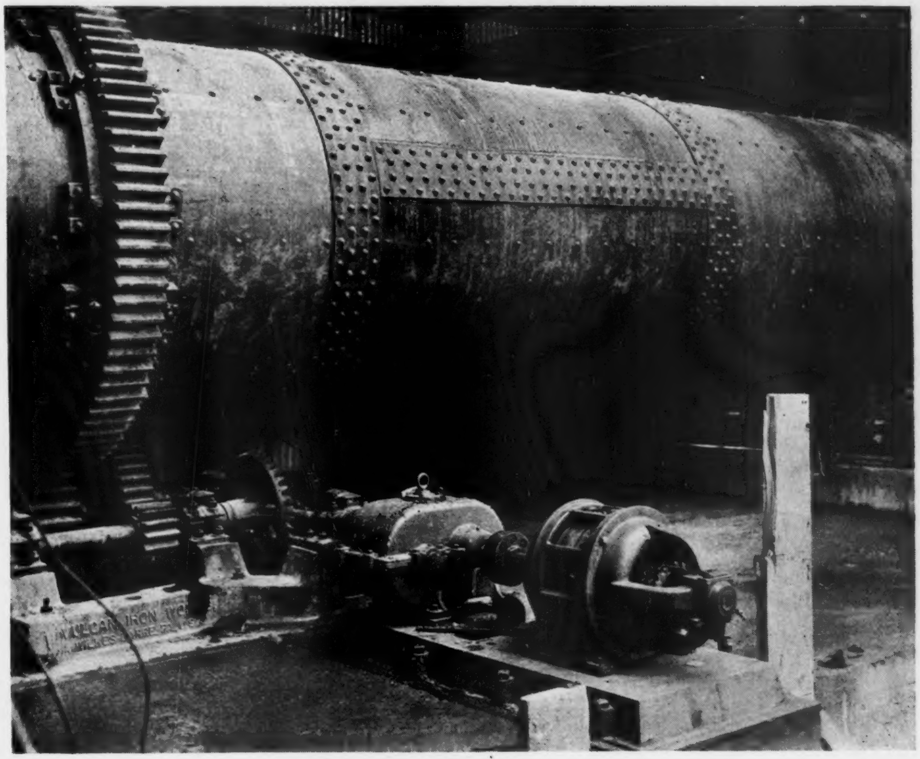
Raw gypsum pulverizer



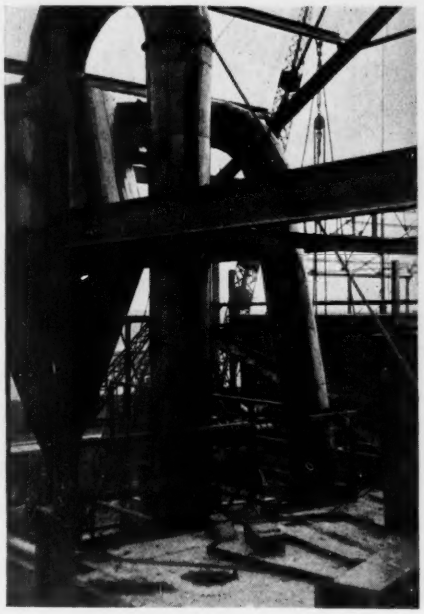
View of mill building taken during construction, showing the relative positions of the equipment

fire the dryer to avoid rock discoloration by the gases. The dryer fan, located at the discharge end of the dryer, is used to pull the hot gases from the furnace through the kiln and also deliver the dust to a cyclone dust-collecting system. The dust-free gases are then allowed to pass out of the stack.

The discharge of the rock dryer is to a chain and bucket elevator feeding to two parabolic-bottom steel bins of about 500 tons total capacity. These bins serve as dried rock storage for the two No. 5 low-side Raymond pulverizing mills. Each mill is equipped with automatic feed control, vacuum air separation and return, dust collector and exhaust fan and is operated by a



Rotary dryer and drive

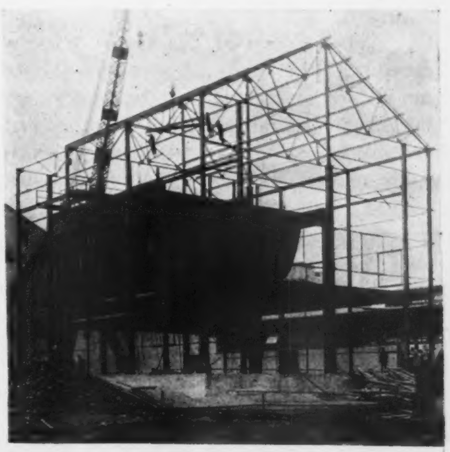


Cyclone dust collector over pulverizer

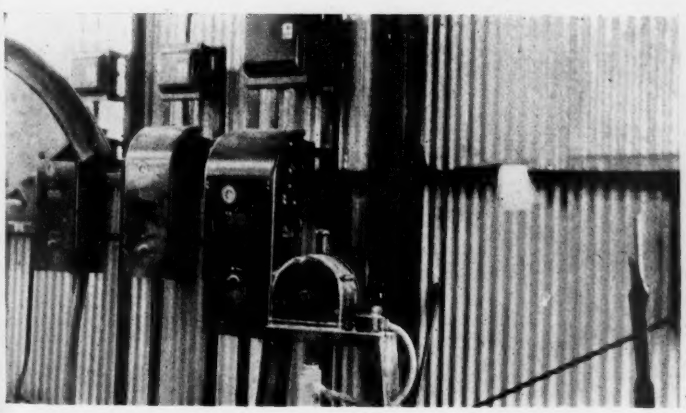
75-hp. electric motor. The mill fan, a No. 12, is driven by a 50-hp. motor. The capacity of the mill is about 17 tons per hour of dried material, 92% through 100-mesh. The pulverized raw gypsum is then carried by means of screw conveyor running in a gallery to three steel parabolic-bottom bins in the calcining building. These bins have a total capacity of about 240 tons and are equipped with bottom gates to regulate the flow of raw gypsum to the kettles underneath.

Calcining Plant

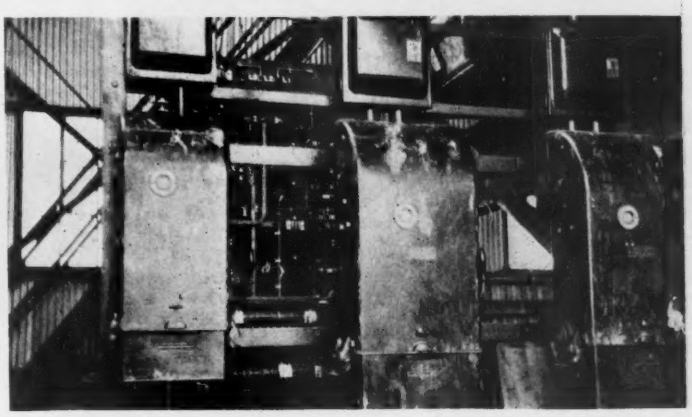
Three 10-ton Ehrsam gypsum kettles have been installed in the calcining building. The pulverized raw gypsum drops through gates on the bin bottom on to a screw conveyor feeding the kettles which are of special design, coal-fired, and equipped with recording thermometers. A single slip-ring electric motor of 20 hp., 440 v., 835 r.p.m., placed between and above the kettles drives the agitators in the kettles and the 9-in. screw conveyor feeds. Each of the kettles has a smokestack, specially designed to assist the recovery of gypsum dust coming out of the kettles. This consists of a regular sheet iron flue within which has been built a smaller cylindrical stack. The inner stack is connected to the top of the kettle and the outer to the fire box flue. Thus separate passages for the waste firing gas and kettle dust and steam are made. The steam and dust from the kettle pass up the inner stack and are heated by the circulating hot gases of the



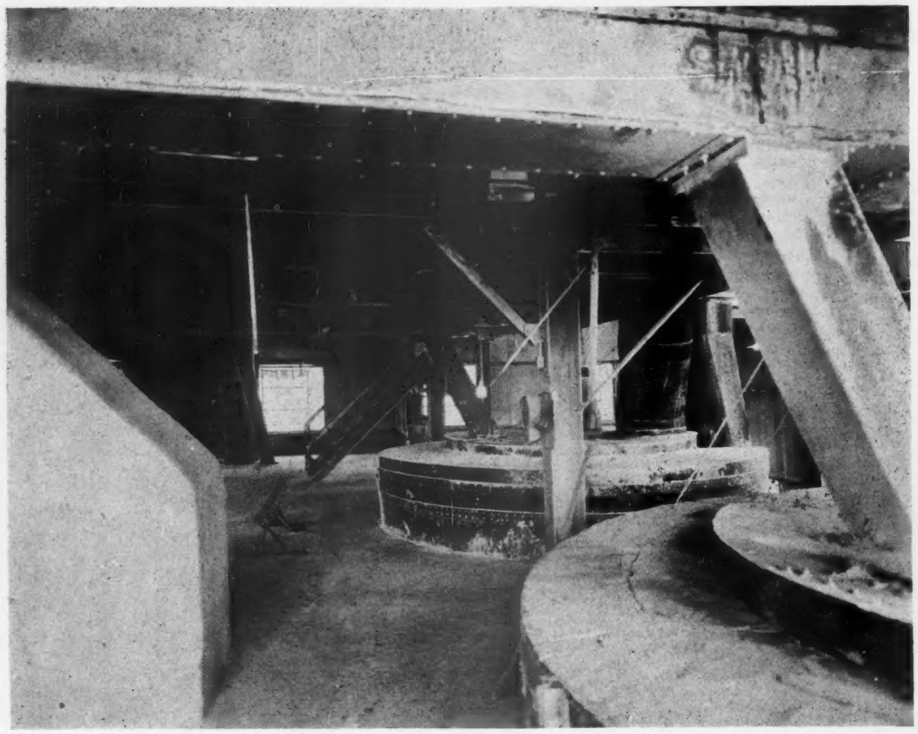
Mixed plaster building
(Picture taken during construction)



Electric controls for mill building machinery. The lever at the right is the hoist control



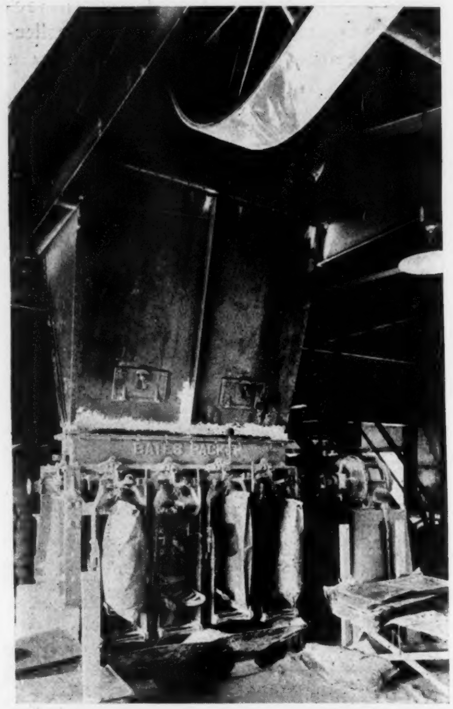
Equipment control boxes for the pulverizer and rock dryer



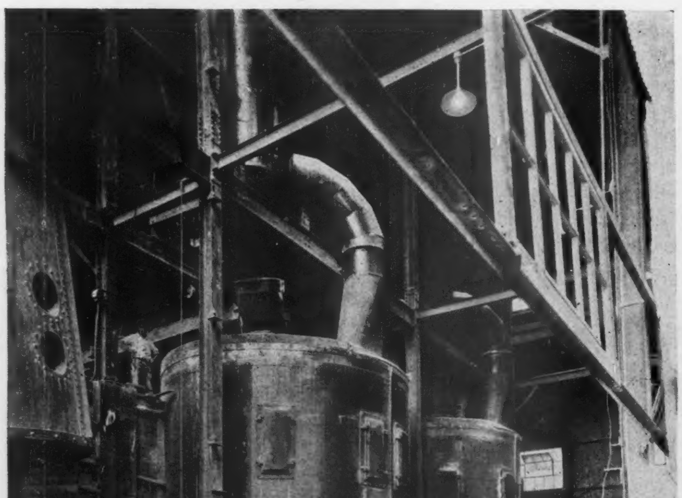
Over the calcining kettles

outer stack; the dried dust is then collected in a dust-collecting arrangement at the top of the building, and the steam passes off through a vent. The furnace gases are discharged to the air from the top of the stack. The purpose of this special stack is to maintain the dust and steam at a high temperature to the point of dust collection and steam discharge, thereby eliminating condensation of the steam to water, which would tend to cake up the gypsum dust and cause it to stick to the sides of the kettle stack. A screw conveyor running in the bottom of the "V"-shaped dust collector returns the collected dust to the kettles or raw storage bins. Push-button control boxes and a reversible control device for the kettle agitators are placed on the operating platform near the kettles.

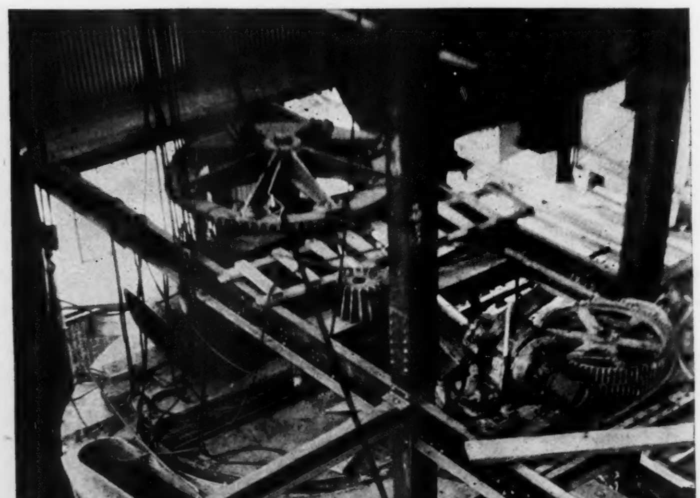
Each kettle has a hot pit of concrete construction, located under the operating floor, of sufficient capacity to hold the contents of one kettle. The discharging equipment consists of Ehrsam hot pit emptiers driven by gears from a line shaft feeding a common cross 12-in. screw conveyor which discharges to a bucket elevator; the hot pit emptiers and cross conveyor being driven by a 15-hp. 900-r.p.m. motor. The stucco is carried by the elevator to the top of the plant and passes over a Niagara Junior No. 2 vibrating screen, the elevator being driven by a 15-hp., 900-r.p.m. and the screen being driven by a 2-hp., 1200-r.p.m.



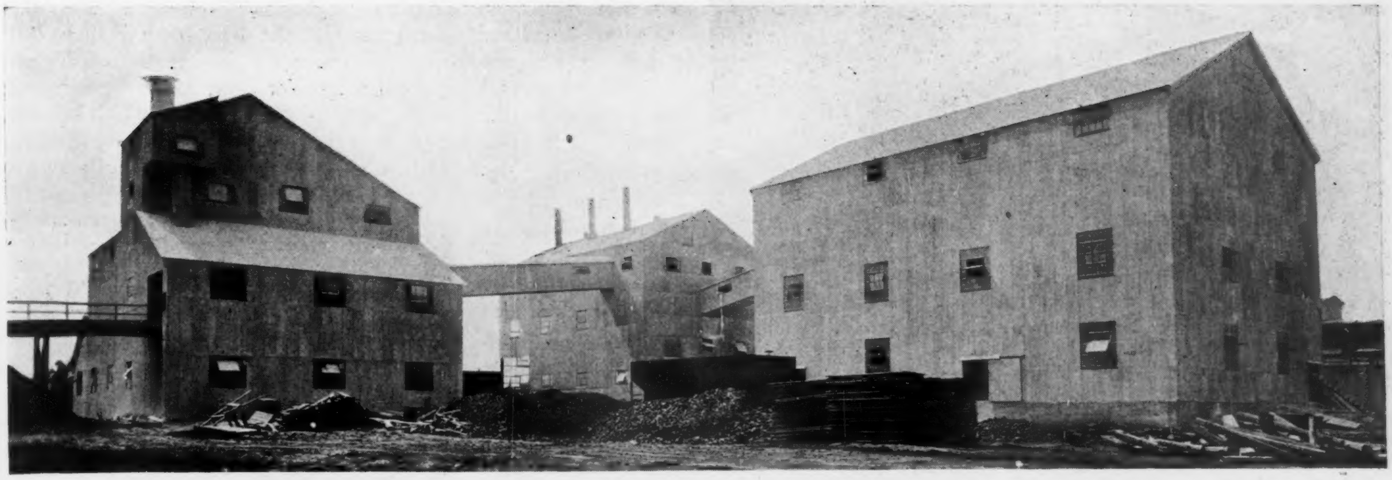
Four-spout packer in mixed plaster plant



Interior of calcining building showing the three kettles and the peculiar stack to stop condensation of moisture



Looking down on the kettles during erection. The motor between the kettles drives the agitators and conveyor feeds



Exterior views of mill building (left), calcining plant (center), and mixed plaster plant (right)

motor. The screened stucco then passes to either the storage bin at the board plant or to the mixing plant by means of 12-in. screw conveyors.

Mixed Plaster Plant

The mixing plant is located 85 ft. east of the calcining building with a bridge connecting. The building is 60 ft. wide and 66 ft. long, of structural steel construction and steel sash and covered with galvanized iron. The stucco from the calcining building is conveyed to the warehouse by means of a 12-in. screw conveyor driven by a 10-hp., 900-r.p.m. motor from which it is conveyed by a number of 12-in. cross conveyors, all driven from a common line shaft with a series of clutches, to a series of six storage bins, four of 200 tons capacity each and two of 100 tons capacity each. The stucco from the four 200-ton storage bins is re-elevated into the two 100-ton bins located over the mixers by means of drag chains beneath the bins and two 50-ton-per-hour capacity bucket elevators.

The system of screw conveyors is so designed that the material can be taken out of any one bin and conveyed into any of the others; thus making it possible to handle a number of different grades of stucco.

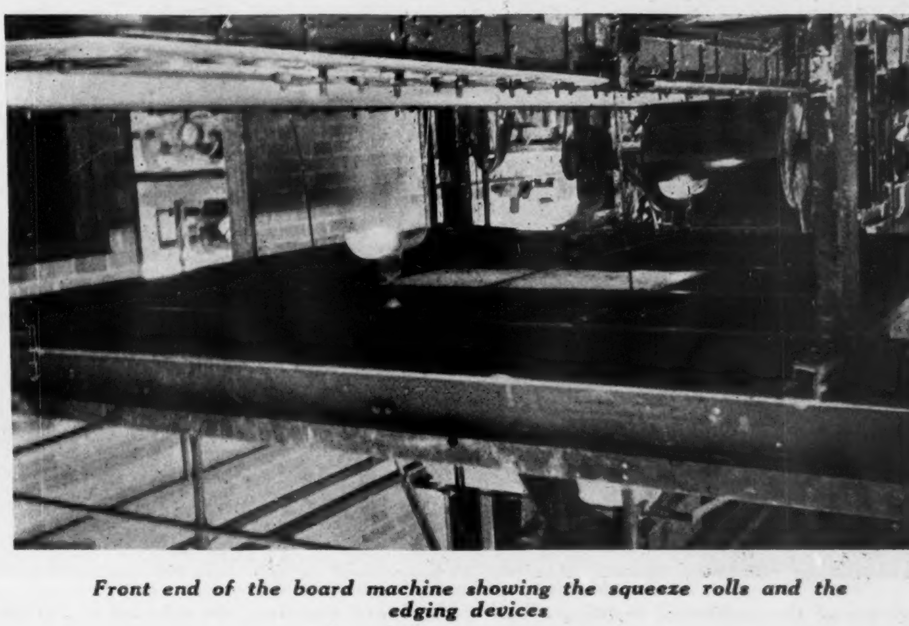
The mixers and weigh bins are located beneath the two 100-ton storage bins and are fed by a 9-in. conveyor, all of which are driven from line shafts connected to a 20-hp. motor, two Ehrsam 1-ton mixers being used. The mixers are discharged into two 4-valve Bates sackers located on the loading floor directly opposite the car-loading doors, with approximately 15-ft. trucking distance. The spill from the sackers is handled by a series of 6-in. screw conveyors and small elevators, returning the material to the bins over the sackers. The various mixing materials are elevated to the mixing floor by means of a one-ton freight elevator manufactured by the Warsaw Elevator Co., electrically controlled from either floor or by the operator on the elevator.

Wallboard Manufacture

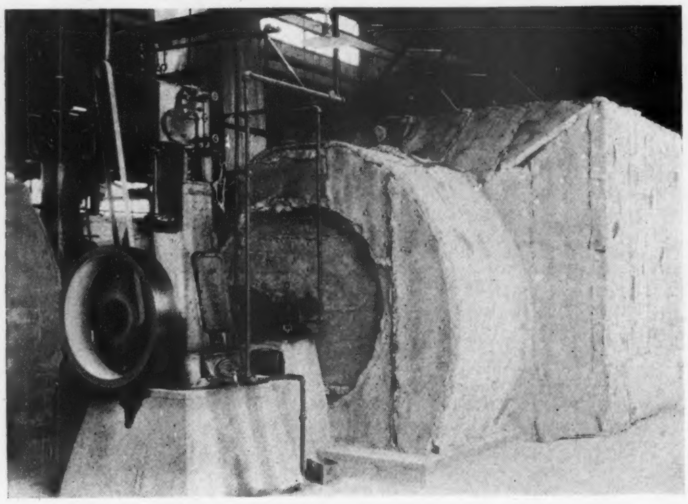
The stucco is stored in one 300-ton hopper steel bin over the mixing platform located at one side of the board machine. The mixers are mounted on a platform and operated by means of control levers and auto-electrical devices through which the proportions of water and stucco and the time of mixing may be varied as desired. By means of a drag chain running through the bottom of the storage bin and an electrically controlled Richardson automatic scale, determined amounts of plaster are delivered to the mixers with measured quantities of water and the whole thoroughly mixed for a time and then dumped to the wet belt cross-conveyor feeding the board machine. At the board machine, the stucco plaster drops on the bottom paper, which is slowly being drawn to the squeeze rolls. The bottom paper comes from a roll mounted on a spindle at the rear of the machine, and as it passes along, both edges are trimmed by rotating circular cutters driven by small electric motors over which are placed suction boxes to draw off any paper dust. These suction boxes are connected to a motor-driven fan. The top paper, located on a platform over the machine just before the squeeze rolls, is also trimmed in a similar manner. This assures a correct width for both papers before they pass to the squeeze rolls.

The bottom paper with the stucco plaster is slowly drawn along to a point under the squeeze rolls where the top paper coming along the top roll meets it. The rolls pressing on the top paper spread the stucco evenly underneath it, and the green board formed in this way passes along. The top roll has 2 in. of dead end at each side along the circumference—so that as the board is being made, the outer edges are being formed by the pressure of the roll end and prevent the plaster core from seeping out at the edges. These squeeze rolls were made by the Duplex Buffing Machine Co., Buffalo.

The entire board machine is 625 ft. long, but is really divided in three sections. The first of these is about 300 ft. long and consists of an endless 52-in. rubber belt, running on steel rollers, spaced 6, 9 and 12 in. apart. An automatic gravity take-up, made by the Huron Industries, Alpena, is located in a pit near the center of the machine. This part of the board machine is driven



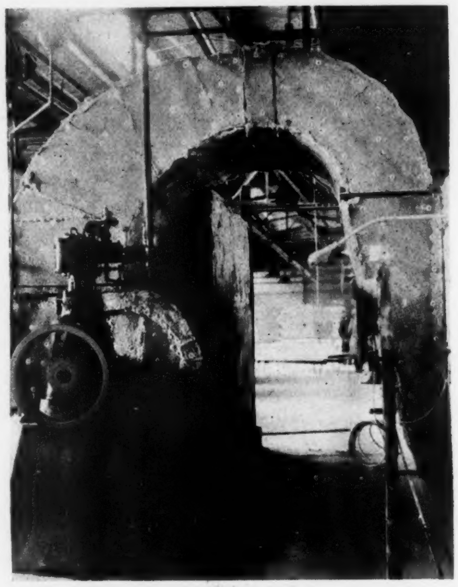
Front end of the board machine showing the squeeze rolls and the edging devices



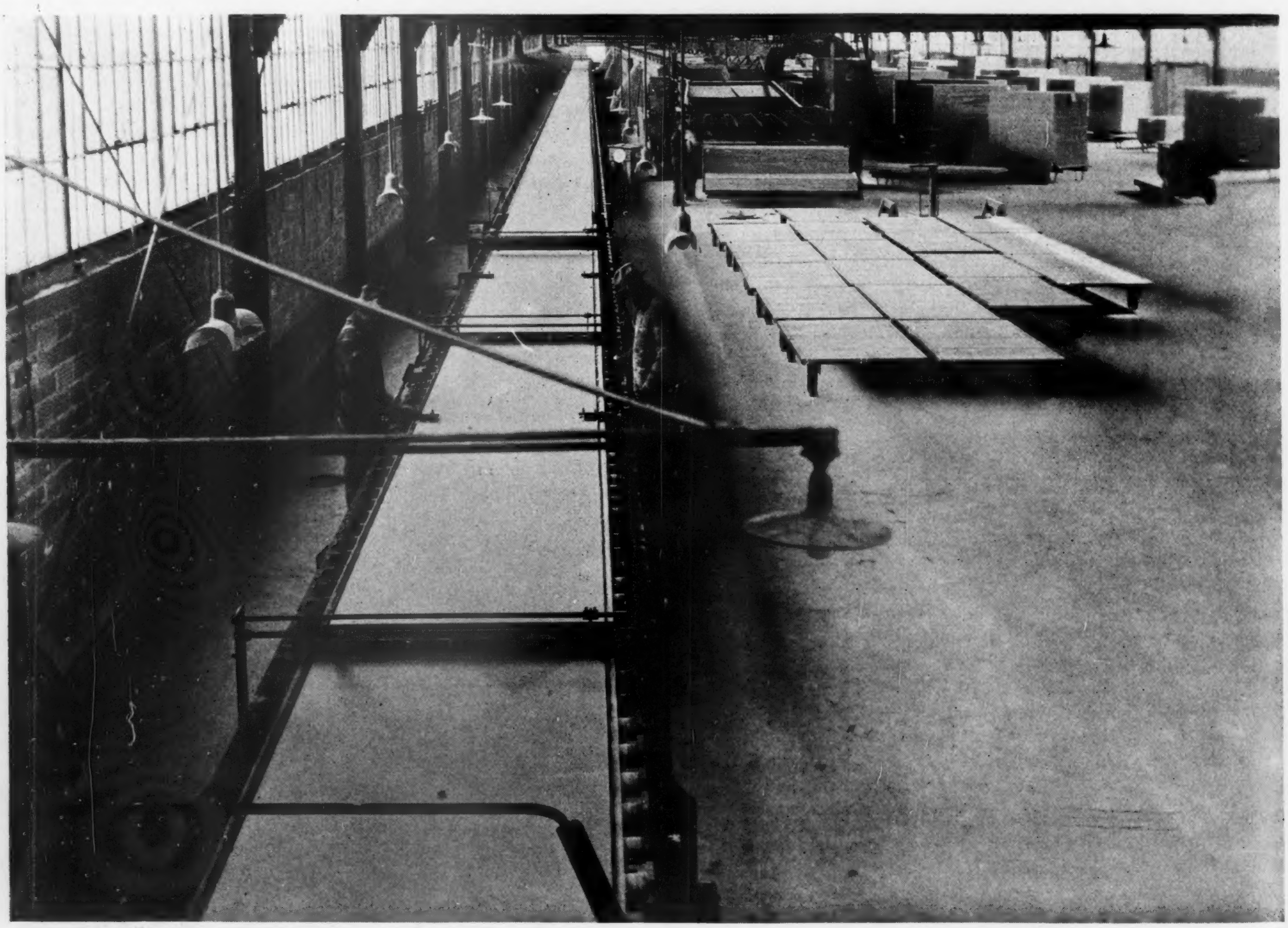
Air circulating fan and drive at the dry end of the dryer

by a 10-hp. 900 r.p.m. slip-ring electric motor through a Reeves No. 3 remote control variable transmission drive. For about 40 ft. along the length of the board machine, commencing from the squeeze rolls, brass edging devices on both sides are kept at a firm pressure against the edges of the green board. This edging device smooths the board edges before final set. Farther along the board machine edge runners are set on both sides at regular intervals and likewise thickness gages resting on the green board are placed. These also tend to give a final smoothing to the board.

The second or carrier section of the board machine is equipped with brass rollers upon which the board rests. This is about 290 ft. long, commencing at the end of the belt conveyor and ending at the cutter. Every 30th roller of the section of "live," that is, it is connected by gears to a driven line shaft, operated by the same motor that drives the first section. An automatic measuring device at the end of the section permits the board to be cut in regular lengths, a Knowlton registering cutter being used. The knife is driven by a separate 3-hp. 900-r.p.m. electric motor through a Reeves No. 0 variable transmission. From here the cut board passes to the third or "speed" section, a continuation of the board machine in which the carrying rolls move at a greater speed. This section is driven in the "live" roller manner as the carrier section, the drive being a 3-h.p., 900 r.p.m. electric motor. The green boards then pass to a transfer table, a cross roller conveyor made by the Coe Manufacturing Co. This table is operated by a 5-hp. 900-r.p.m. electric motor driven through a Huron In-



Fan and steam engine drive on the exhaust end of the dryer



Interior of the wallboard building showing the board machine, the take-off end of the dryer and storage piles of finished board

Looking along the wallboard manufacturing building. The power plant shows at the extreme left

dustries speed reducer of 10:1 reduction ratio. The rollers are mounted on ball bearings. From the transfer table the boards, two at a time, are run to the dryer feeder, a steel frame along which moving narrow rubber belts resting on steel rollers elevate the board to the dryer. The operator from a position near the cutting knife controls the transfer table, speed table and dryer feed, and can raise the feeder so that it will deliver the green board to any tier in the dryer.

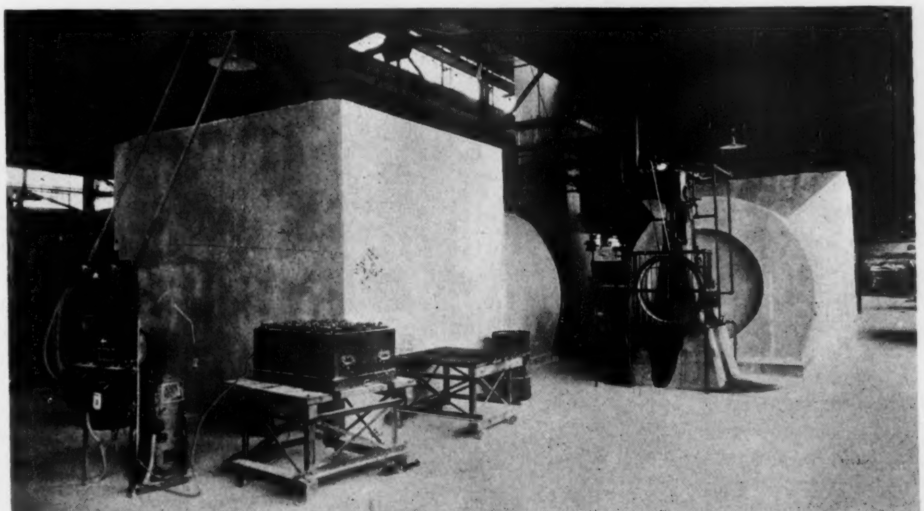
Dryer

The continuous roller dryer, furnished by the Coe Manufacturing Co., is 395 ft. long—one of the longest ever built by the company—and is driven by a Sturtevant VS-7, 4x5, 250-r.p.m. steam engine, belt connected to a Reeves No. 1 variable transmission. The company thought it wise to install steam drive, for should the electric power shut down at any time, there would still be sufficient steam to permit the engine to operate at a low speed and the boards in the dryer could coast along. With electric power, a temporary cutting off of current would result in the board burning up in the dryer. Since the dryer holds 30,000 sq. ft., it is easy to see what a serious damage would result unless the precautions to minimize such accidents were taken.

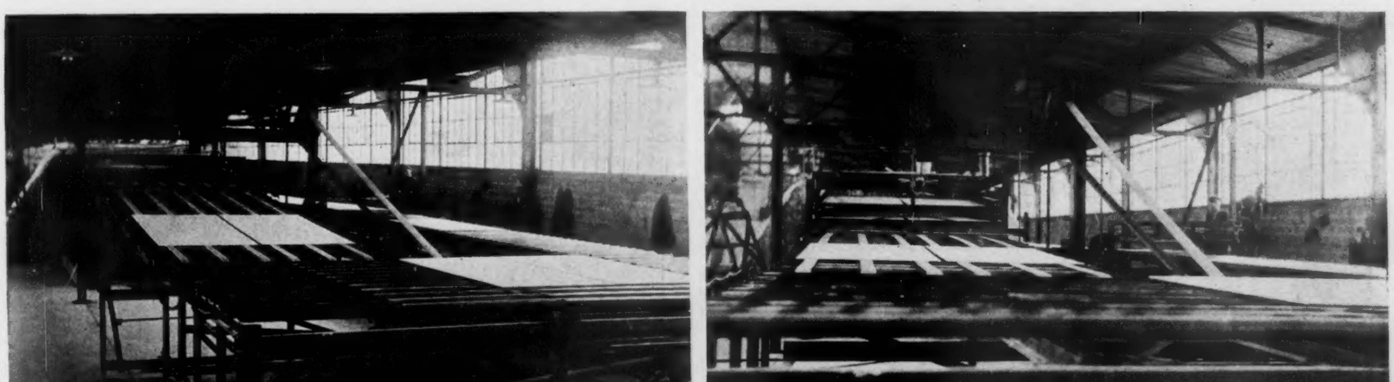
The dryer consists of four sections, namely, the wet end, the dry end, the finishing end, and cooling section. The wet and dry ends are connected to two air circulating fans, each a No. 13 Sturtevant blower driven by a Sturtevant VS-7 8x9 steam engine. The exhaust air is taken care of by a Sturtevant Multivane No. 10 blower driven by a Sturtevant VS-7x67 steam engine. The finishing section is connected to a Sturtevant blower driven by a VS-7 4x5 steam engine. The exhaust from all engines connected to the dryer is utilized in drying the board and reduced to water before returning to the boiler; thus practically eliminating much of the cost of operating the blowers. The steam for the dryer is supplied by a 500-hp. Sterling boiler equipped with pulverized coal firing.

The kiln doors are of the hinge type the entire length of the dryer, so that in case of jams access to the interior of the dryer can be readily had and also the condition of the board can be observed by opening any one of these doors. Incidentally, cooler conditions at any part of the dryer can be obtained by opening some of the doors and allowing the excess heat to escape. Four Foxboro recording thermometers are installed, one for each section.

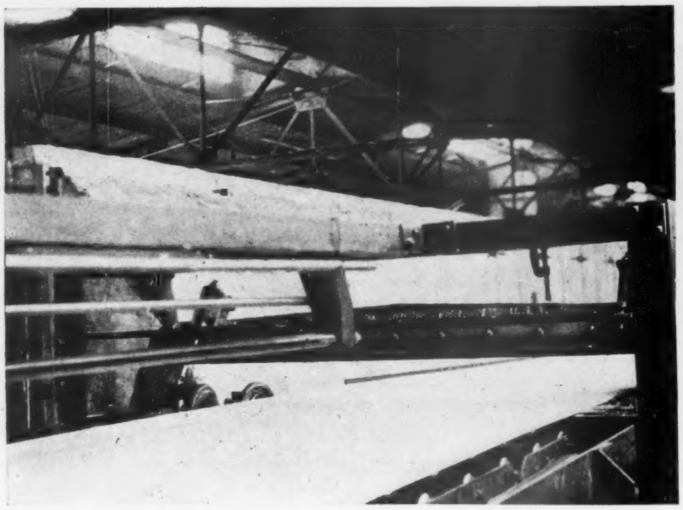
The dried boards are taken off the discharge end of the dryer by two men and before being placed on nearby skids are carefully examined for defects by an inspector. This inspection is rather rigid and includes a test for elasticity—two men at opposite ends taking hold of the corners of the board and giving it a rapid up and down swing. Every hour one of the boards as it comes out of the dryer is placed between two saw horses, 6 ft. apart. Sash weights, each of 5-lb. weight, are then piled up in the center until the board breaks. This is carefully recorded. The basis for this lay test is rather novel—it allows the company salesmen to perform a comparative strength test



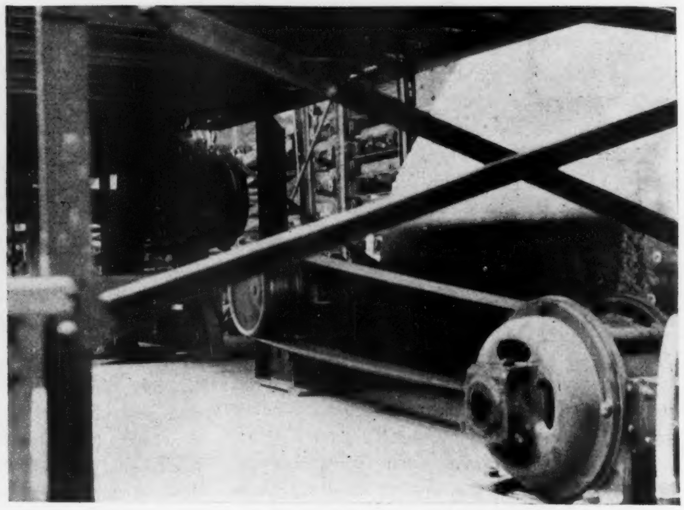
Blowers for conditioning and recirculating air in the dryer



Transfer table and dryer feeder carrying green boards to the dryer



Cut-off end of board machine and cutting knife



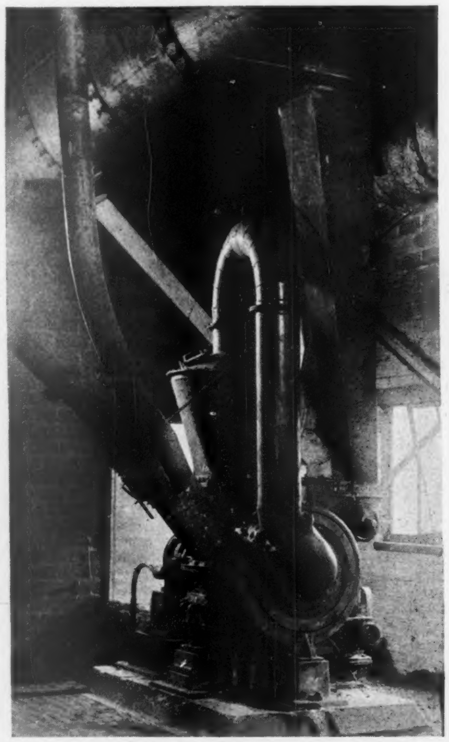
Variable transmission drive of wallboard machine

with competitive boards at any building material dealer's yard, and in such a way that the dealer can easily comprehend. A few breaking tests were witnessed and all of the boards sustained a load of 105 lb. on the 6-ft. span, with several breaking only after 125 lb. had been placed.

The skids on which the finished boards are placed are substantially constructed of forged steel framework with a wooden top bolted securely in place. There are about 125 of them, all furnished by the Lewis-Shepard Co., Boston. An Elwell-Parker 5-ton storage battery truck is used to carry the skid and load to the cars to be loaded, or elsewhere on the floor.

Buildings

The board plant is of steel frame and hollow tile construction, with concrete floor, and is 704 ft. long and 74 ft. wide, with an addition, 50x110 ft., on the northwest corner which will be used for a mixing room. A double loading track runs along the south side on the plant on which 26 cars for loading may be placed. The entire building is extremely well lighted and airy. The steel work on this plant, mill building and calcining building was furnished and erected by the Buffalo Structural Steel Co., Buffalo.

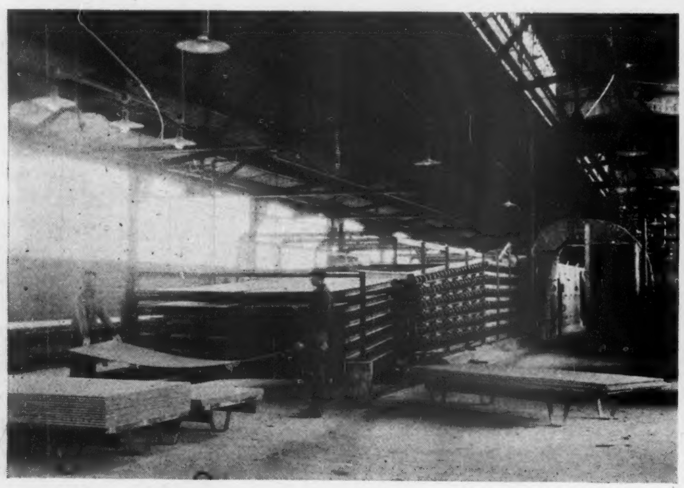


Coal pulverizer and motor drive

The plaster and storage plant was built by the Lackawanna Steel Construction Co. of Buffalo, N. Y., who also furnished all the structural steel for them. These buildings, as well as the mill building and calcining building, are enclosed in galvanized iron siding, all of which was put in place by the Bruno Martin Co., Saginaw, Mich. The board plant was put up and equipment installed under the direction of T. J. Ryan, superintendent of the wallboard plant.

Power House

The power house is a separate building of structural steel and hollow tile walls, situated to one side and along the board plant, and is equipped with modern devices. The coal is either taken from a large storage pile by means of a drag scraper or direct from the hopper bottom coal cars to a storage bin above and in front of the boiler by means of screw conveyors and a bucket elevator, the coal bin having a capacity of 60 tons. Beneath the coal bin the coal passes to a Raymond No. 45 unit pulverizer which pulverizes the coal to 64% through 100 mesh. The pulverizer is driven by a 30-hp. 1800-r.p.m. motor with a separate 2-hp. motor for controlling the feed. The pulverizer



Removing finished board from dryer

Piles of finished board stacked for loading on cars

grinds and blows the coal directly into the boiler furnace through two pulverized coal burners of special design, eliminating any pulverized coal storage. The boiler is capable of generating 750 hp.

The boiler feed consists of a Crane direct return system returning the water to the boiler from between 250 and 285 deg., thus creating a large saving in coal. The auxiliary feed is a Gould "Triplex" pump connected to a set of reducing gears and a 5000-gal. water storage tank located above the pump, thus assuring positive boiler feed supply. No ash-handling equipment has been provided, inasmuch as the amount of ash is practically negligible, for the ash pit is emptied approximately once every month and at the time but little ash has accumulated, almost all of the ash going up the smokestack.

Another novel feature about the power house is that air for combustion is preheated by the stack gases and sucks through the pulverizer by the pulverizer fan. This assists the pulverizer in grinding wet coal as well as aiding combustion.

The plant water supply is furnished by Tabor centrifugal pumps connected to a 1,500,000-gal. water reservoir fed by a natural spring creek located 1000 ft. from the plant.

Summary

All the electric motors used at the plant were furnished by the General Electric Co. The electrical work connected with installing was all done by the company under the supervision of George Knickerbocker, chief electrician. The conveyor belts were furnished by the Goodyear Tire and Rubber Co. and leather transmission belts by the New York Belting and Packing Co. Power is purchased from the Consumers Power Co. and is stepped down from 44,000 v. to the 440 v. used throughout the plant by three transformers, each of 200 k. v. a. These were furnished and installed by the Consumers company.

Throughout the entire plant the design is such that future expansion is possible without dislodging or interrupting the present arrangement. Later it is planned to put up another board plant parallel to the one already in operation, and also a block plant. The present schedule calls for the production of about 8000 tons of mixed plaster per month, this in addition to the requirements of the board plant. Even at this early date the board plant is operating 24 hr. per day, and although not yet on a capacity basis, is being rapidly sped up to the desired production. An interesting feature is that outside of the actual operating heads, the workers were recruited from the townspeople—nearly all of whom had never worked in a mill, at least a gypsum mill, before.

Ground at National City was broken on October 1, 1926, and the board mill was completed and in operation on April 15, 1927. Not a record, to be sure, but considering the difficulties of a Northern Michigan winter and the great distance to the construction materials and equipment sources—a very creditable performance.

The entire supervision of construction, erection and placing of machinery was done by the company. Not every organization has the type of men who can be taken out of their supervisory capacity in one mill and sent to a new location and there build up a plant, break in new men, and carry on in an efficient manner. But the executives, both directing and operating, have all had a wide and varied experience in gypsum, gathered from mills in many parts of the United States, and the new plant at National City and the older one at Clarence is sufficient proof of their ability to apply this.

The operating personnel at National City comprises H. B. Brockenbaugh, general superintendent; T. J. Ryan, superintendent of the board plant; Ed Michaels, night foreman; A. Peterson, engineer and draftsman; Ed Davis, quarry foreman; V. E. Gustafson, in charge of quality control, and R. Dahne, office manager. P. J. Harrigan is chief mines engineer; A. H. Brunner, chief engineer, and R. P. Holderbaum in charge of research and quality, all having headquarters at the home office in Buffalo, N. Y.

J. F. Haggerty is president of the company; C. E. Williams is vice-president and treasurer; M. H. Baker, vice-president and general sales manager; J. J. Turner, production manager. The office of the company is at Jackson building, Buffalo, N. Y.

The company's expansion program is definitely fixed and Rock Products expects in future issues to describe its further activities. The two mixing plants at Clarence Center, N. Y., and National City, Mich., are the first step in the program of expansion.

Seattle Wallboard Companies Combine

It is announced that the Western Wallboard Co. of Seattle, Wash., and the Seattle Division of the Schumacher Wallboard Corp. have combined and will operate under the name, Gypsum Products Corp.

The officers of the new combination are: George O. Gray, president and general manager; A. R. Moylan, vice-president; Kenneth McLeod, secretary and production manager; H. H. Tice, treasurer, and Otto Peck, assistant treasurer and office manager. Charles V. Harrington is in charge of sales. The office of the Gypsum Products Corp. is at 6851 East Marginal Way, Seattle.

Officers and personnel of National Gypsum Co. Left to right—R. Dahne, office manager; P. J. Harrigan, general superintendent of mines; H. B. Brockenbaugh, general superintendent; T. J. Ryan, construction superintendent; J. Anderson, director; M. H. Baker, vice-president and general sales manager; R. Smith, Michigan state geologist; Charles Burkhardt, director; D. K. Robinson, construction engineer; Ed Davis, quarry foreman; J. F. Haggerty, president; H. N. Butler, Eastern Michigan sales manager; Charles Coryell, Jr.; W. G. Houck, director, and A. H. Brunner, chief engineer

The Rock Products Industries in Texas

Roadbuilding and Demand for Aggregates — New Gypsum Deposit—Developments at the Southwest's Oldest Cement Plant

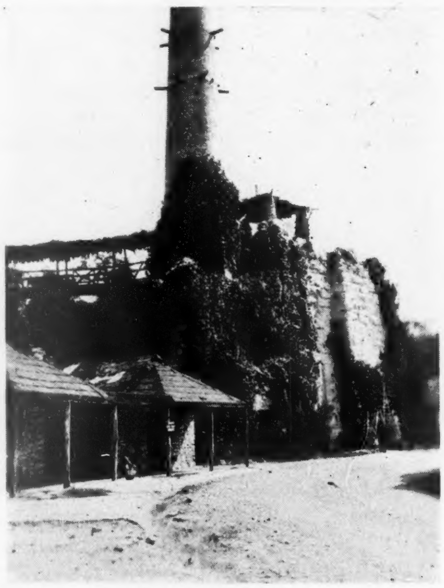
By Edmund Shaw
Editor, Rock Products

AT the state highway engineer's office in Austin, Texas, I was told that the great Bankhead highway, 880 miles long, running east and west, was all of an approved type of construction except for work that was being completed in three of the many counties through which it passes. Equal progress has been made on the north and south highway that runs through some of the principal cities of the state to Laredo on the Mexican border. In addition to these there are other important highways completed and nearing completion which form part of a through state highway system. The remarkable thing about this is that all roads are primarily county roads with state and federal authorities approving types and sharing in the cost of building. The people of the outlying counties must have shown far more public spirit than those who are similarly situated in some other states.

Large Highway Appropriation

About $20,000,000 are to be spent on highways this year, half for new construction and half for maintenance. The program calls for about 200 miles of concrete road and 100 miles of an approved bituminous type.

Aggregates and road building materials in general are not too plentiful in Texas. Fortunately the deposits which are worked lie in fairly close reach of the large centers of population. Thus, gravel is produced in some abundance near Fort Worth and Dallas and stone is brought in at a relatively slight cost over that of gravel. Gravel is also obtainable near Houston and at other places on the coastal plain. San Antonio has probably the best sources to draw from as there are the big limestone ledges at New Braunfels, the trap rock (basalt) dikes at Knippa and the gravel and sand deposits all around the city. El Paso, with its great limestone mountain and abundant stream gravels, is almost equally well off.



Shaft kiln and pot kilns of the first San Antonio cement plant

Number of New Plants

A number of new plants in the various branches of the rock products industry have been built since I visited the state a little over a year ago. Most of them are doubtless familiar to ROCK PRODUCTS readers as notices of them have appeared in the news pages of the paper from time to time. An interesting discovery of gypsum in the coastal plain country is worth noting. It has been found in connection with a salt dome deposit of the sort that oil men know all about. Texas is already a heavy producer of gypsum, the deposits lying on the western edge of the exposure of Pennsylvanian and Permian rocks that covers so much of the central area of the state. This new discovery may mean that more accessible resources in the eastern part of the state can be developed.

Cement Industry Busy

The cement industry seems to be doing as well here as in other parts of the South that have been visited on this trip. At the office of the Trinity company in Dallas, I was told that the new plant of this company in Houston was 75% completed so that it will not be long now before its production is

The two pot kilns each produced 10 to 12 bbl. daily. The shaft kiln production was about 62 bbl. per day

The city has turned the old cement quarry into a beautiful sunken garden

added. The question of, "who is going to use all the cement?" again comes up, but a lot of it will be used inside the state lines. Texas is gaining rapidly in population. The last census gave it something like 4,000,000, but I am told now that it has nearly 5,500,-

Above—One of the old buhr stones now used as a picnic table

000 people, as closely as such an estimate can be made.

Pioneering in Cement Manufacture

A visit to San Antonio gave me one of the pleasantest experiences I remember, in meeting Charles Baumberger, president of the San Antonio Portland Cement Co., and hearing him describe his early efforts to establish a cement industry. It is extraordinary to find that one of the first cement plants in the United States was established here in 1880, when San Antonio was little more than a rough, frontier town. The city has fortunately perserved the old kilns in the beautiful Breckenridge park, which has been built around the old plant, and has turned the quarry into the famous sunken garden that is so familiar from often-published photographs. That was well done, but it was of even greater importance to preserve the old kilns as a record of growth of one of the town's principal industries, and for the uses of the student of our industrial history.

The story has been told before, but Mr. Baumberger told me some details that I am sure have not been commonly published. He started business with only $3100 capital and his little plant had a weary time to establish itself. The material burned was the Austin chalk which is still used to make cement in the present San Antonio plant and in Dallas. This he first made into hydraulic lime, then to natural or Roman cement and finally to true portland cement. The original pot kilns (two of them) each produced 10 to 12 bbl. per day, and when the big shaft kiln producing 62 bbl. of portland cement per day was built, it marked a long step in advance. This portland cement was made from the blue rock of the ledge which ran 75% $CaCO_3$ or about the same as the cement rock of the Lehigh valley.

Mr. Baumberger has his first grinding mill, an Edwards horizontal mill about as big as a barrel. A legend on the cast iron face announces proudly that it is "the best grinder in the world." But before that burr-stone mills were used and some of the old stones are now used as picnic tables by visitors to the park.

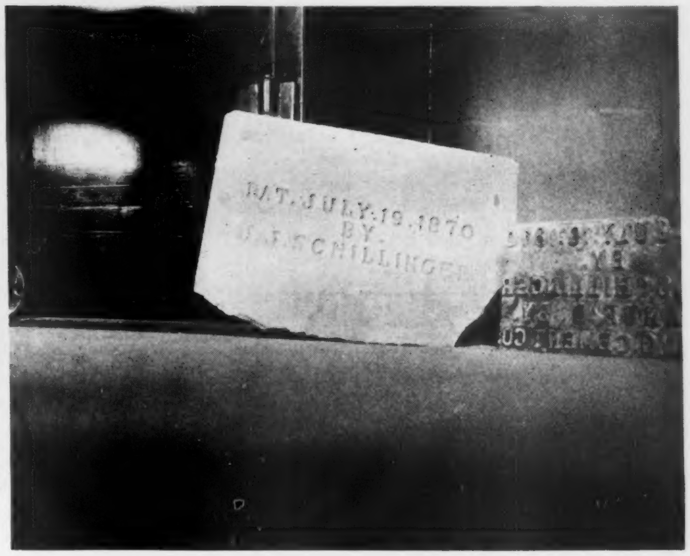
It was interesting to learn from Mr. Baumberger that the common method of laying cement sidewalks and scoring them

Charles Baumberger and the safety trophy awarded the San Antonio mill in 1924

to prevent expansion cracks was patented by a man named Schilling in 1870. The patent held when tested by infringement suits, too. Mr. Baumberger bought the patent because he could use it to help out his cement business. A royalty of 5c per yard was charged if the cement used was imported, but only 2c per yard was charged when San Antonio cement was used. The lowered royalty was an inducement that helped to sell many a barrel of cement.

Uncovering Cement Manufacture Secrets

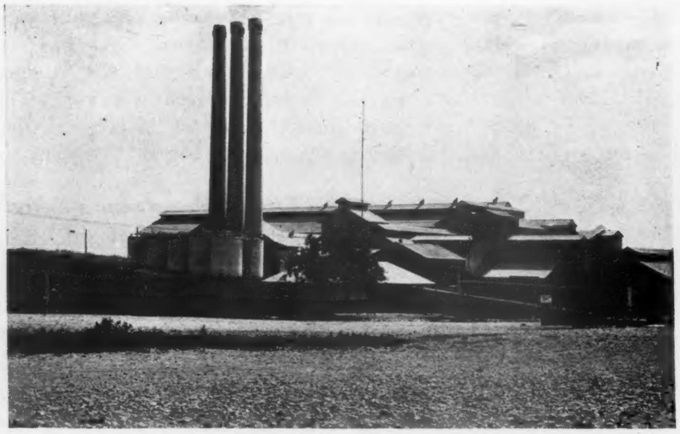
But perhaps the most interesting detail of all was the way the use of gypsum to retard the setting of cement was discovered. At



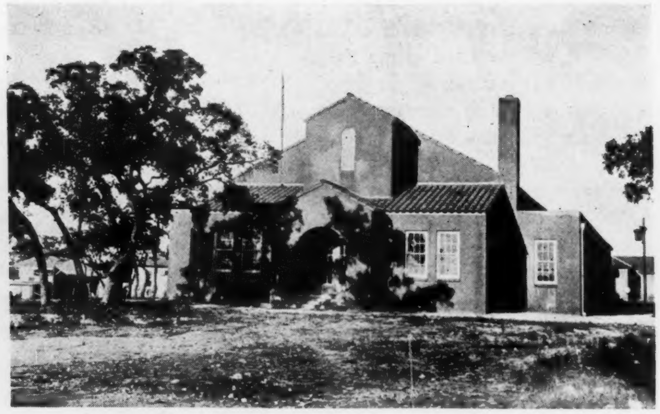
Below — Stamp of the patent that helped to sell cement to make sidewalks

the time the use of gypsum was a cement maker's secret. Mr. Baumberger subscribed to the German paper, *Tonindustrie Zeitung,* which is still devoted in part to the cement industry, and studied its pages carefully without finding what he wanted. At last he got a sample of German cement and examined it under a miscroscope. Some white specks showed and he carefully picked these out with the point of a needle until he had enough to test chemically. Gypsum was suspected and the little sample was tested for sulphur with positive results. A little experimenting with mixtures of cement and gypsum showed him that the cement makers' secret was a secret no longer.

All this seems far in the past, and yet Mr. Baumberger cannot be called an old man, for he still gives full attention to the business and gets about and drives his car with the sureness that only comes from excellent health and steady nerves. One feels a bit envious of such a happy and successful life as he has lived, starting in the smallest way, pioneering not for a state or a county but for a nation, meeting and overcoming discouragements, financial as well as technical, and coming out at last as the head of a great business with one of the most modern plants in the country. And he has a son worthy of such a father to take up the work when he wishes to lay it down. We sometimes feel that our industry lacks background and tradition, but here is one instance in which one man has made plenty of both to inspire those who will follow him.



The new wet process plant of the San Antonio Portland Cement Co.



Community Hall (all of concrete) built by Mr. Baumberger for his workers' social affairs

Changing from the dry to the wet process, Mr. Baumberger and his associates have built a new plant throughout, very little of the old dry-process mill being saved. It would not be well to anticipate the story of the plant that is to be published shortly, but there are some general facts about it that are interesting at this point. One of these is that it has a very successful installation of full-Diesel engines which produces about as cheap power as any cement plant in the country uses. And another is that for safety and personnel work the plant stands very high among the plants of the United States. From the pride with which Mr. Baumberger showed the safety trophy awarded the plant in 1925 one may see that he values it quite as highly as anything connected with the plant.

The company has about 500 acres of ground and calls its village Cementville. Good housing is provided for the employes and recently a community hall, which is a beautiful example of all concrete construction has been erected in which picture shows and the social affairs, in which the workmen and their families participate, are held. It is much appreciated by the men.

Houston Cement Shell Industry

Texas Portland and New Plant of Trinity Need Large Tonnages

Shells are not rock products, but anything made from reef-shell may be described as in the rock products class without straining the language. For a shell reef is one kind of limestone in its original, unconsolidated form, and shell is used for many of the purposes for which limestone is quarried and crushed.

Shell reefs occur at many points on the coast, especially where the sea water is warm. They are large enough to be worked commercially near Norfolk, Va., Morgan City, La., Houston, Texas, and perhaps some other points on the Atlantic and Gulf coasts, and near Redwood City, Calif. They are worked as a gravel or sand bar would be worked, by pumping with suction dredges.

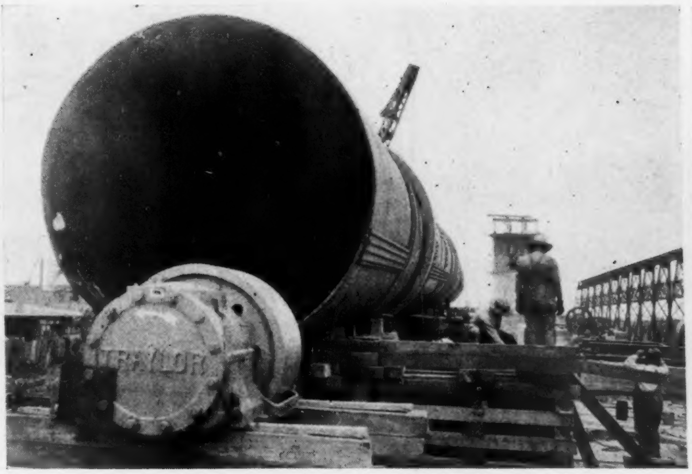
The conditions necessary to produce a shell reef, or bed (for both terms are used), are said to be a fairly shallow arm of the sea, defended from all but the severest storms, into which a fresh water river debouches. In an inlet of this character oysters find the warm and quiet water and abundance of food that causes them to breed well. Periodically an extra rainy season will cause the fresh water river to flow into the inlet so strongly that most of the oysters are killed. After the bay has turned salt again the oysters will begin to spawn, using the old shells as a breeding ground. Then another fresh water inundation kills them off and so the reef is built. One of the reefs at Houston, which it is said, will produce shell for forty years to come at the present rate, has a depth of 35 ft.

The shell recovered is sometimes washed and screened but more often used "as is." Some of its uses are for road material, railroad ballast, cement raw material, and to a limited extent as concrete aggregate. Lime has been burned from shell but only in small plants, from what the writer has been able to learn. Crushing shell for chicken grits and agricultural "limestone" is a recognized industry. In a short time, at least four cement plants in the United States will be using it as raw material.

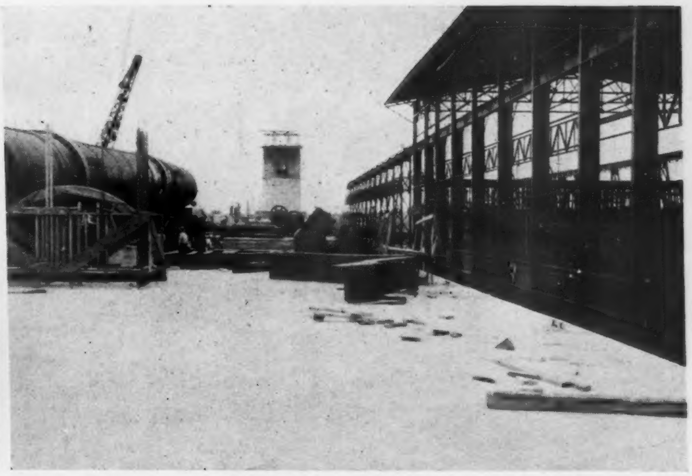
Not a Cheap Material

Contrary to a common opinion shell is not a cheap material. At Houston, Texas, where this article is written, it sells from \$1.25 to \$1.50 per cu. yd. at retail yards. It is dredged in Galveston Bay and then has to be barged up to the city through Buffalo Bayou and the ship channel, a distance of about 50 miles. The price seems low enough when the long water haul is taken into consideration.

New dredge of the W. D. Haden Co., Houston, built especially to dig shell for cement raw material



The 11 ft. 3 in. by 300 ft. kiln of the new Trinity plant being rolled on its foundations



Concrete platform over all the slurry tanks on which two kilns will eventually be mounted

One plant in Houston, that of the Texas Portland Cement Co., has been making cement of shell for 12 years. Neither plant nor process differs materially from the ordinary type in which limestone is used, except that there is no crushing department. Shell is unloaded from barges and handled to a stockpile by a travelling crane and the same crane afterward delivers it to the hoppers of the raw grind plant. Smidth Kominuters are used as preliminary grinders and these are followed by Smidth tube mills. The kilns, which are oil-fired, are 220 ft. long and 10 ft. in diameter for about a third of the way, the remainder being 8 ft. in diameter.

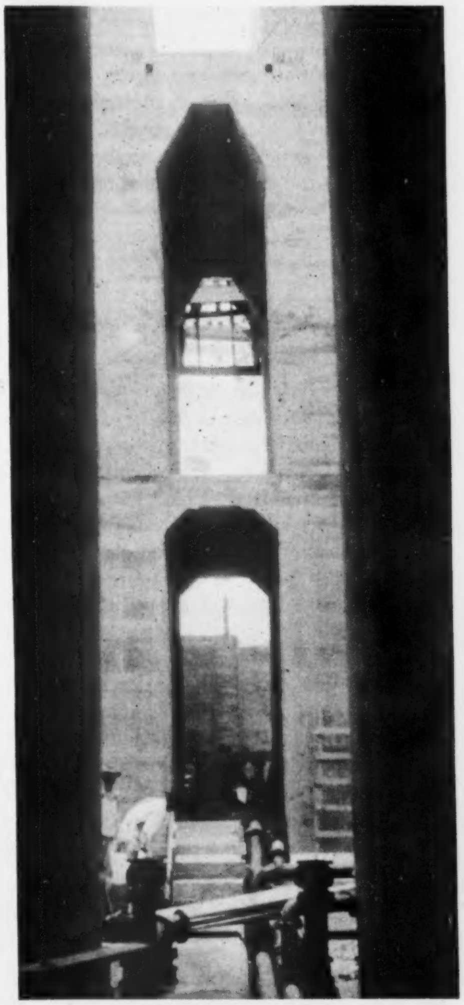
Making cement from shell was more or less of an experiment when this plant was built, but the experiment was in every way successful and the product has a high reputation on the Gulf coast. Incidentally, the plant is one of the handsomest and best kept plants that has been visited. The grounds are laid out into lawns with palm trees and flower beds and many a public park might envy their appearance.

New Dredge for Cement Shell

The shell is bought from the W. D. Haden Co. of Galveston and Houston, one of the largest producers of shell in this territory. It dredges well over a million yards yearly, and it also produces and sells gravel and other building materials. For cement purposes the shell must contain less than 5% of sand this means that it has to be pretty carefully washed and screened on the dredge.

The Haden company is building a new dredge which has been designed especially for producing cement shell and which is one of the best pump boats the writer has seen anywhere. It will be described in a forthcoming issue. It is Diesel-driven and has washing and screening equipment designed to give as clean shell as is commercially possible.

The plant which the Trinity Portland Cement Co. is building at Houston is also to use shell as raw material. It will be ready to operate by the middle of September. This



Looking between two slurry tanks at the massive foundations of the kiln platform

is one of the most interesting plants in the United States because of the many new ideas in layout and equipment that it contains. It was designed by Orville Bartholomew, who is in charge of operations at the company's plants at Dallas and Fort Worth, and who designed the Fort Worth plant. His son, R. O. Bartholomew, had charge of the engineering on the entire plant.

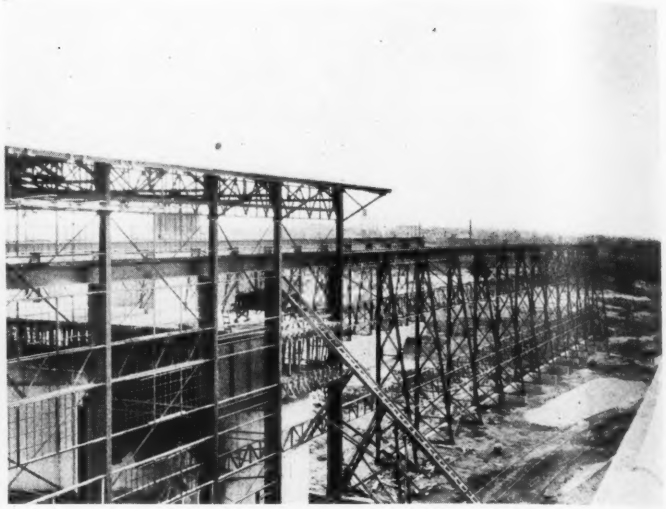
This will add another to the cement plants that are completely surrounded by large and growing cities, but it is unique in that it is situated on a handsome boulevard planned to pass the parks and show places of the city. In order to be worthy of such a situation, rather elaborate plans have been made for landscape gardening and otherwise beautifying the grounds so that the big, white buildings of the plant will rise from a sea of green decorated with flower beds and ornamental shrubs. Every precaution necessary to keep the plant dustless has been made, and little but CO_2 and water vapor, both natural constituents of the atmosphere, will be turned into the air.

Kiln to Be 300 Ft. Long

The plant will have only one kiln at present, but space is left for three more to be added and the grinding mill and storage departments are all planned on a four-kiln basis. Equipment is of the latest type and size. The kilns will be 300 ft. long and 11 ft. 3 in. in diameter. The grinding mills on both the raw and finish side will be 8 ft. in diameter and 40 ft. long. The fuel will be natural gas and all the air that enters the kiln, including that which is fed by the fan with the gas, will be preheated by passing through the coolers.

Owing to the limited space available, the plant layout had to be kept as compact and simple as possible. Shell and clay are to be received in barges and unloaded by a derrick. A crane will place them in storage and will put the clay in the wash mill. After being washed to make a "slip," the clay will be pumped to four large storage tanks from which it will be fed to the raw grind mills. These tanks stand at one side of the mill house which is between the raw storage and the clinker storage. From the raw grind mill the slurry is pumped to the slurry tanks all of which are under a concrete platform on which the kilns (only one at first) are to be placed. The clinker is cooled and then discharged by a shaking conveyor and elevator to the clinker storage from which it

The office building which is finished a pure white, as all the buildings will be



End of grinding plant and shell storage. The tanks between are for storing clay in "slip" form

is fed to the finished grind mills. Cement will be pumped by pneumatic pumps from the mills to the pack house and silos through pipes in a tunnel underground. There is an auxiliary building in which machine shops, warehouse and power house (containing switchboard exciters and air compressors) are placed.

As the pictures prove the construction of this plant is as good as it was possible to make it.

The use of natural gas in this and other Texas plants is a return to the practice of early days when the "gas belt" of Kansas was one of the great cement producing areas of the country. It is rather being forced upon the Texas producers, as fuel oil is getting scarcer yearly. The oil wells are producing as much as ever but the ever increasing demand for gasoline takes more and more of the crude oil produced.

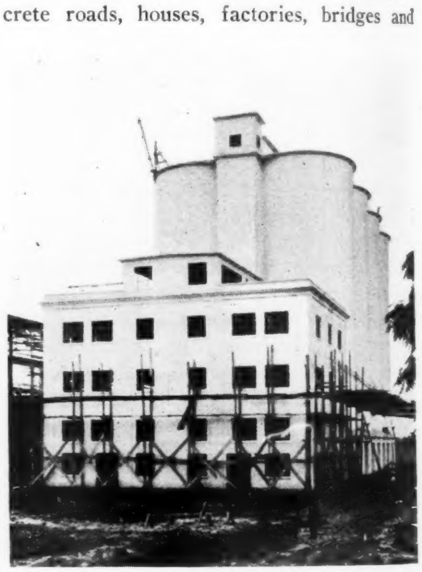
Orville Bartholomew

Gas cannot be considered so economical a fuel as either oil or coal, but it has other advantages in that it is delivered at the kiln with no charge for handling or storing. In some cases the greater cost for fuel has been offset by lessened labor and attendant costs to such an extent that the cost of producing cement per barrel has not been seriously affected by the change to gas firing.

The curious thing about gas as a kiln fuel is that it is less efficient than solid fuels. Being so thoroughly under control and of such a nature that the air burned with it may be exactly regulated and thoroughly mixed, one would think it would be highly efficient. But figures show that it requires about 2,000,000 B.t.u.'s per barrel of cement with gas while the average for the United States is estimated at about 1,600,000 B.t.u.'s with powdered coal. In some cases, where the conditions have been the most favorable, this has been reduced to 1,200,000 B.t.u.'s or only about half of the requirements with gas. It should be added, however, that plants which use so much gas have higher moisture contents in the slurry than plants which use hard limestone rock. It is said that five of the Texas plants will be using gas before the end of the year.

English Increase Use of Portland Cement

FOLLOWING the report of the increased activities in the steel industry, due partly to the demand for this material for constructional purposes, comes the news of growing outputs of cement—essentially a constructional material and used with steel to a large extent as reinforced concrete. The production of portland cement in this country (England) last year amounted to 3,780,436 tons, and the quantity used per capita in the British Isles was 160 lb. In 1925, 3,752,804 tons were produced, representing a use per capita of approximately 152 lb. This increase has been gradual for the past 20 years. In 1907, for example, only 2,886,000 tons were produced, representing a use per capita of 111 lb. Although exports have decreased, portland cement is being used to a greater extent in England, since so many new uses have been found for it—all-concrete roads, houses, factories, bridges and even the more domestic articles such as tanks, troughs, fenceposts and other cement products.—*Contract Journal* (London).



Silos and packhouse

Looking at the grounds from top of packhouse. Flower beds, lawns and shrubbery will cover this area

X-Ray Study of Limestone Calcination

Part II.—Effects Observed During Calcination of Limestone and Clay

By Dr. Friederich Rinne

Director of Minerology and Petrography, University of Leipzig, Germany

PART I of this current series was published in the June 25, 1927, issue, pp. 65-67. It discussed in some detail the history of x-rays, theories of atomic structure and a few applications to technological and chemical processes. This part deals chiefly with the actual phenomena observed during the calcination of limestone and clay and their interpretation.

Passing on to the calcination process, it is obvious that here also only hints can be

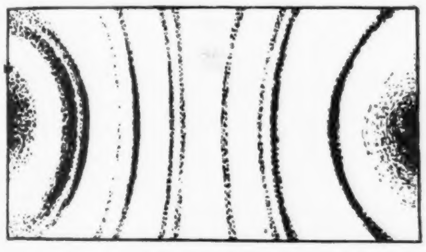


Fig. 13. A Debye-Scherrer diagram

given and that the entire range of cases cannot be covered here. I wish to place special emphasis on clay and limestone. At first, let us consider kaolin, a pure clay, an aluminium-hydro-silicate having the formula $Al_2O_3{\cdot}2SiO_2{\cdot}2H_2O$. Heating produces increasing activity of the small particles of clay with consequent changes. A good idea may be obtained of these changes from the so-called gradient curves. These are obtained by observing the temperature of a substance, heated in a container, by means of a thermometer inserted in the substance or by means of a thermo-couple. The temperature first rises gradually; however, as soon as a change occurs in the sample, resulting in absorption or liberation of heat, this is immediately recorded by the break in the uniform temperature rise. This is represented graphically by plotting the temperature measurements for certain intervals on a diagram (Fig. 14). A heat or temperature gradient shows the development of heat changes in the sample. In Fig. 13 a bend

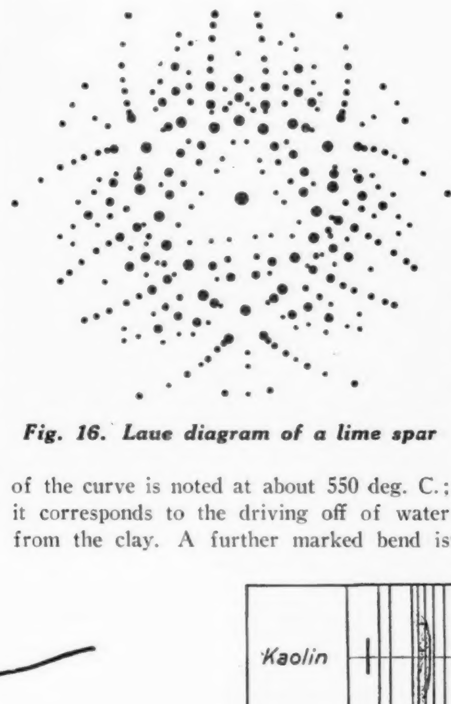


Fig. 16. Laue diagram of a lime spar

of the curve is noted at about 550 deg. C.; it corresponds to the driving off of water from the clay. A further marked bend is encountered around 1000 deg. C. At this temperature important changes take place in the silicate residue. Just what takes place at this point still receives different explanations.

According to the interpretation commonly

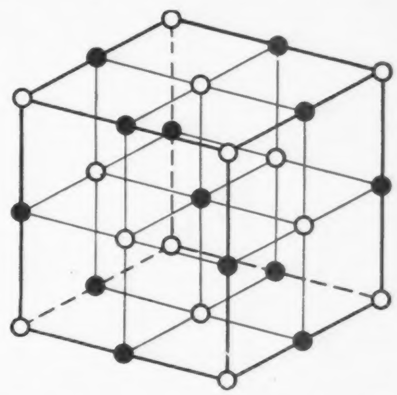


Fig. 17. Atomic structure of lime spar.

adopted before, sillimanite, i. e., $Al_2O_3{\cdot}SiO_2$ and SiO_2 are produced during burning. Bowen, however, claims to have found the compound $3Al_2O_3{\cdot}2SiO_2$, the so-called mullite, and SiO_2 and denies the presence of sillimanite. These changes in structure are important as they have an effect on such properties as hardness, fusibility, shrinkage manifest in the clay products. Therefore, it is of utmost importance to determine the true nature of the changes involved. We

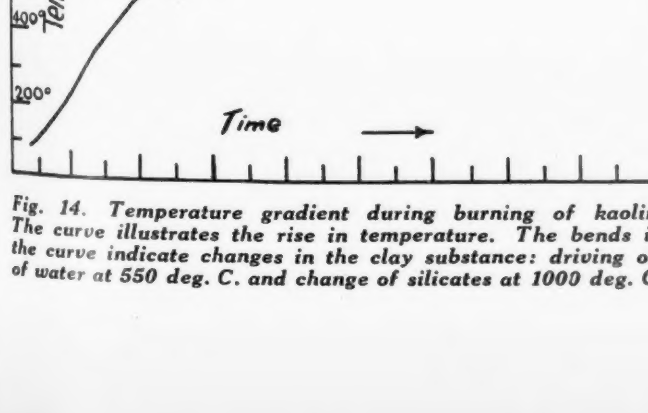


Fig. 14. Temperature gradient during burning of kaolin. The curve illustrates the rise in temperature. The bends in the curve indicate changes in the clay substance: driving off of water at 550 deg. C. and change of silicates at 1000 deg. C.

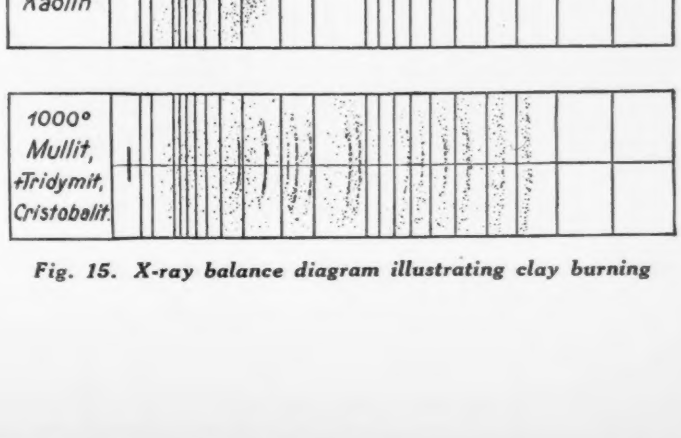


Fig. 15. X-ray balance diagram illustrating clay burning

are accordingly grateful to the Kaiser Wilhelm Institute for Silicate Research in Berlin-Dahlem for taking up this subject. X-ray studies have greatly aided this end. Professor Eitel, director of this institute, is undoubtedly correct in stating that mullite, if formed, would not remain stable, but breaks up into sillimanite with inclusions of Al_2O_3. This aluminium oxide is present in a finely dispersed state in the sillimanite crystals, whose presence is confirmed.

In following out the x-ray balance diagrams of clay and its products at different temperatures, the kaolin spectrum is recognized in the raw material. The conditions are different at 550 deg. C.; a number of lines are missing and it appears that the entire atomic structure has been upset. Clearly visible lines again make their appearance at 1000 deg. C. These are even more pronounced at 1400 deg. C., the diagram (Fig. 15) pointing to the presence of sillimanite and tridymite or christobalite (both SiO_2). The so-called mullite has practically the same spectrum as sillimanite and is, therefore, but a modification of the latter.

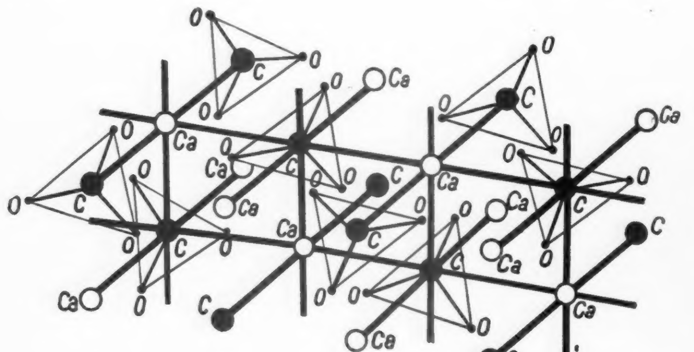


Fig. 19. Atomic structure of lime spar in stereometrical projection

It is to be hoped for that the entire important processes involved in clay burning will be cleared within reasonable time.

Another example may be the burning of lime. Limestone in its pure form is a calcium carbonate ($CaCO_3$), that is, a lime spar. There are two other stable forms of calcium carbonate: aragonite and vaterite. Neither of the latter is of any importance to us as they are changed to lime spar during burning. A third compound may be mentioned here—the magnesium carbonate ($MgCO_3$), and also the calcium-magnesium-carbonate, or dolomite ($CaCO_3 \cdot MgCO_3$).

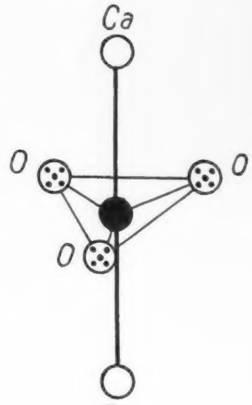


Fig. 18. Partial diagram of the atomic structure of lime spar

Let us first consider the processes involved in the burning of limestone. As is known, calcium carbonate becomes decomposed into burned lime—CaO and carbon dioxide—CO_2. Accordingly, magnesite forms MgO and CO_2. The question arises whether the calcium and magnesium oxides produced are in a crystalline or amorphous state.

In this connection let us consider the x-ray evidence of the raw material. The Laue diagram (Fig. 16) yields a perfect structure in the case of lime spar. It is equally suited to treatment by other methods mentioned above. We find that it has a structure similar to rock salt, though not

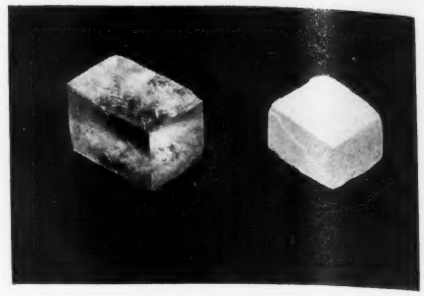


Fig. 20. Left a natural and right a burned lime spar crystal

through cubical shape of elementary particles, but through its cubical structure with face angles of 105°05′. This so-called rhombohedron has the following structure: calcium ions appear at the corners of the rhombohedron and in the centers of the faces. CO_3 appears at centers of edges and, in addition, a CO_3 group is located at the center of the entire structure. Each CO_3 group is formed by a carbon atom at the center with three oxygen atoms forming an equilateral triangle around it. (See Figs. 17, 18, 19 for illustration of these points.)

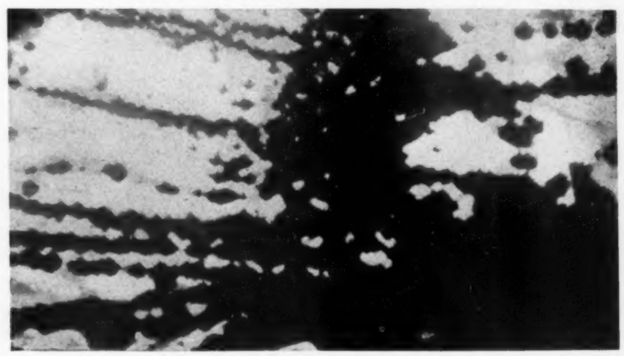


Fig. 22. Progress of burning spots in lime spar

A so-called topochemical reaction takes place during the burning of limestone. It is limited to the range of solid substances and, therefore, proceeds without considerable decomposition. Each limestone particle, in general, retains its shape during burning. (See Fig. 20.) We are dealing here with a so-called pseudometamorphosis of calcium ox-

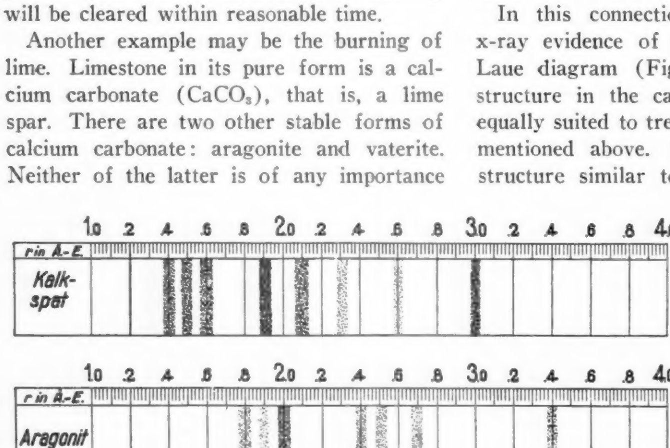


Fig. 23. X-ray spectra of the three modifications of calcium carbonate

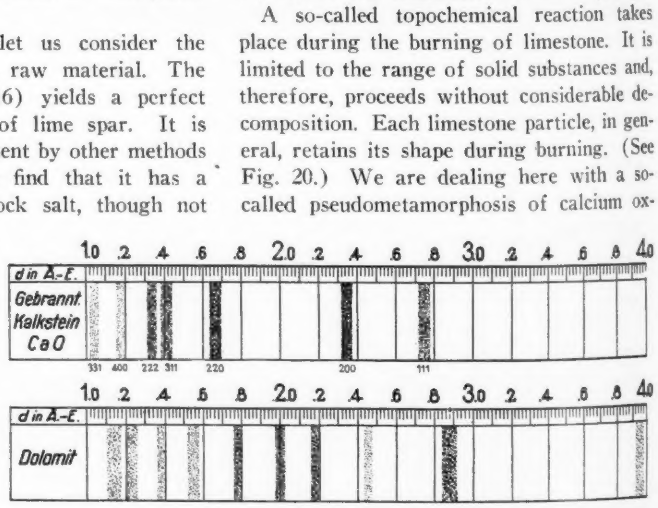


Fig. 24. X-ray spectra of burned lime, dolomite and burned dolomite

ide to lime spar. If a microscope is used, a very clear phenomenon may be observed along the surfaces of cleavage of the limestone, which, to my knowledge, has not been recorded before. Burning proceeds, namely, —at least when carried on gradually,—not at once over the entire surface of the limestone cleavage particles, but we encounter here so-called burning figures (Fig. 21), i. e., spots of regular shape which appear singly or in groups and finally spread over the entire surface. Along the cleavage surfaces of the minerals they have the shape bordered by the cleavage planes (Fig. 22).

In making x-ray studies of the relations involved in earthy or powdered materials, such as limestone and lime, use is made of the Debye method. It shows a very characteristic spectrum for lime spar proper as well as for aragonite, vaterite and lime (Fig. 23).

Comparing this with the burning of dolo-

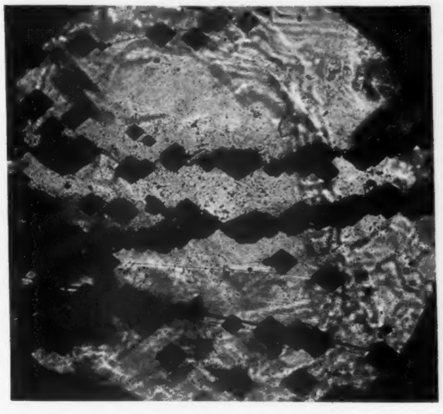


Fig. 21. Burning spots of lime spar

upper and lower vertices of a rhombohedron. A section through the center of Fig. 26 shows a replacement of calcium by magnesium. The CO_3 groups are placed as in

is an increase of 13% in quantity and 15% in value compared with 1925. Every important producing state except Texas showed an increase. The output was reported by 14 operators in seven states in 1926, namely, California, Florida, Georgia, Illinois, Massachusetts, Nevada and Texas. Georgia was the leading state in production in 1926, with Florida second and Illinois third. These three states produced 82% of the total output. The average value per ton of fuller's earth was $14.33 in 1926 compared with $14.15 in 1925.

Fuller's earth is a term used to include a variety of natural substances that possess the property of absorbing grease or clarifying, bleaching or filtering oil. They are mostly clay-like substances, though recently discovered material in the West, which is of different character, is said to be superior to the eastern fuller's earth. The original use of fuller's earth was in the fulling of cloth, but little of it is now used for this purpose. It is used almost exclusively in the bleaching or filtering of vegetable and mineral oils.

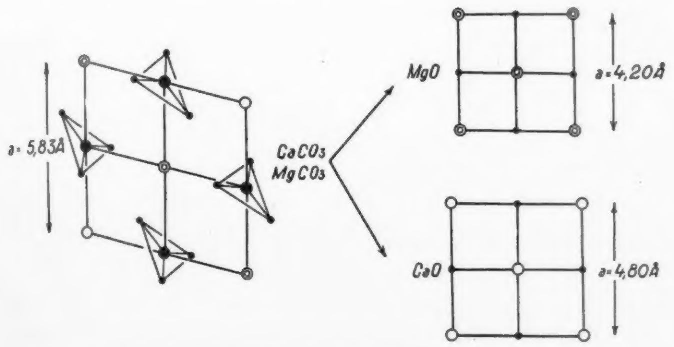


Fig. 26. Atomic structure during burning of dolomite. Left—atomic structure of dolomite and right—that of burned dolomite (a mixture of MgO and CaO)

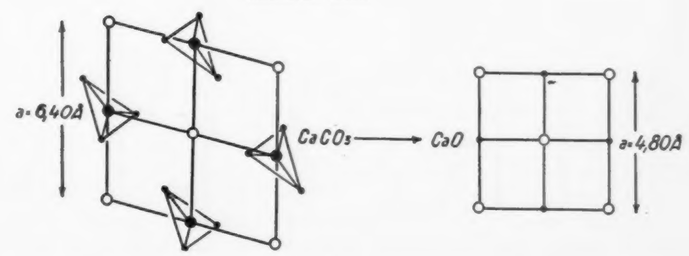


Fig. 25. Atomic structure during burning of limestone. Left—shows atomic structure of lime spray and right that of lime. Dimensions in Angstrom units (0.000 000 01 cm.)

mite, we find that the Debye-Scherrer diagram of the pure original compound yields a characteristic spectrum. The product of burning could be either a mixture of molecules, a chemical compound or isolated crystals of CaO and MgO. X-rays clearly show that two different bodies are formed, one constituted by CaO; the other by MgO. The x-ray graph thus shows a mechanical mixture of the two oxides.

Let us now consider the dynamic action of atoms during the burning of carbonates. (Fig. 25.) The prevailing, trivalent symmetry does not permit direct liberation of CO_2. One O-atom is as good as its two neighbors in the structural group of CO_3. CO_3 must, therefore, separate as a whole and react with Ca to form CaO and CO_2.

The structure of the calcium oxide produced, the lime, is well known. It is a regular, crystalline structure. The corners of the elementary cubes and the centers of their faces are occupied by Ca; the oxygen atoms are located at the centers of the edges and form a submicroscopically fine structure at the center of the whole. A strong contraction is manifest upon comparison of this elementary cube with that of $CaCO_3$, as indicated by the figures in Fig. 24.

Dolomite has the following structure of atoms: The calcium atoms appear at the upper and lower vertices of a rhombohedron.

lime spar. Burning thus results in processes corresponding to those of lime spar. As shown in Fig. 25, the contraction resulting through the formation of MgO is even more marked than for CaO.

Clay and lime burning, though frequently the subject of researches, still present the possibilities of discovering new and interesting characteristic relations; x-rays form an excellent medium for the analysis of the stereochemical forces involved.

The author has attempted to show in a small book how varied and extensive is the field of application of this wonderful physical agency. Readers who might be further interested are referred to this work.[1]

Increased Production of Fuller's Earth in 1926

THE fuller's earth sold or used by producers in the United States in 1926 amounted to 234,152 short tons, valued at $3,356,482, it is announced by the United States Bureau of Mines, Department of Commerce, which has collected statistics in co-operation with the Geological Surveys of Florida, Georgia, Illinois and Texas. This

[1] F. Rinne, The atomic structure of matter in accordance with crystalline formation, 3rd edition, Gebr. Borntrager, publ., Schoneberger Ufer 12a, Berlin.

Until 1895, when fuller's earth was successfully produced commercially in Florida, the United States was entirely dependent on foreign supplies. In 1926 the imports of fuller's earth were 9,098 short tons, valued at $123,674, an increase of 14% in quantity and 11% in value compared with 1925.

The exports of fuller's earth are not separately shown by the Bureau of Foreign and Domestic Commerce, but five producers reported that in 1926 they exported 6,650 short tons of fuller's earth, which was a slight increase over 1925.

Testing Laboratory Directory

THE National Bureau of Standards, Washington, D. C., has recently issued a directory of commercial testing and college research laboratories of the United States. The purpose of the directory is to inform manufacturers and interested parties of the location of these laboratories, together with indications of the commodity types they are prepared to test. The list includes 207 commercial laboratories and 143 college laboratories which are used for instruction purposes and also research work. Copies of this publication, No. 90, are available at 15 cents each from the Government Printing Office, Washington, D. C.

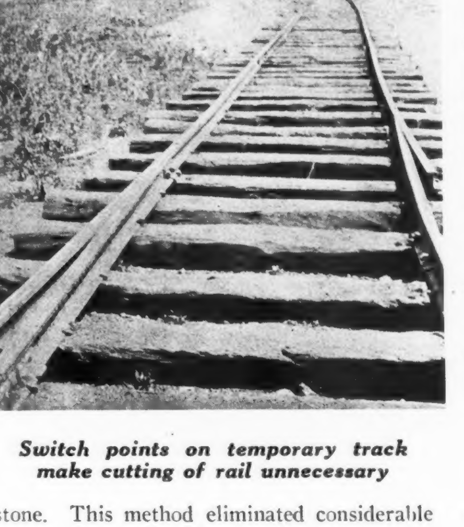
Hints and Helps for Superintendents

Use of Switch Points to Avoid Cutting Rails

THE method of using switch points to avoid cutting rails, which is shown in the accompanying picture, is said to be an old trick with contractors and railroad men who have to construct temporary tracks, and it has been used in some quarries. Still, as the plant where the picture was taken went on cutting rails for two or three years before the use of switch points was discovered, there may be others who do not know about it, and these will find that the method will save both expense and trouble.

The track shown is used around the edge of a large gravel pit. The cars that run on it are standard gage and are loaded with a dragline. As the work progresses the track has to be shifted over, and this changes the length, making it necessary to add rails at every shift. As the distance is fixed by the position of the track to the dragline, the rails added do not often come out to even lengths, and a rail has to be cut or the method shown here must be used.

The picture was taken at one of the gravel plants near Montgomery, Ala.



Switch points on temporary track make cutting of rail unnecessary

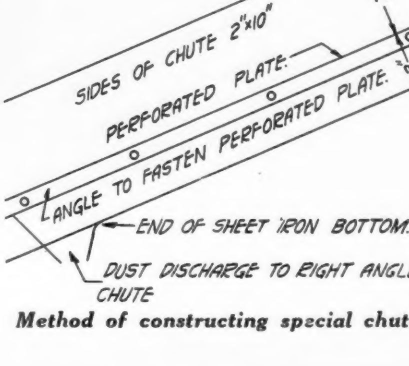
Device for Producing Clean Stone in Wet Weather

By ALBERT SMITH

Superintendent, Port Deposit, Md., plant, General Crushed Stone Co.

WE had considerable trouble in wet weather in screening our small size stone owing to our separating screen carrying a peak load. To overcome this we used old screen plate for the bottom of the chutes delivering from the separating screen to the bins using 3/16-in. perforated plate for the ½-in. stone and ½-in. perforated plate for the ¾-in. stone. This method eliminated considerable of the trouble, but I went further and put chutes under the bin gates delivering to the railroad cars using the same size perforation for the above mentioned stone. In making these chutes (see photo and sketch) I used 2x10-in. boards 7 ft. long for the sides, bolting a piece of light angle iron to each board 3-in. up from the bottom. The perforated plate was bolted to these angles and a piece of light sheet iron was nailed on the bottom edges of the boards, allowing the sheet iron to extend down 6 ft. or within a foot of the end of the chute. This sheet iron collected the dust coming through the perforated plate and delivered it to a small chute set at right angles to the main chute. The small chute was hung on hinges to the main chute and was raised and lowered with a small block and fall, the lowering chute discharging the dust on the ground or into a wheelbarrow at the side of the railroad car, the chutes with perforated plates being 2 ft. in width. This method has improved our conditions so that we are able to produce practically clean stone in wet weather.

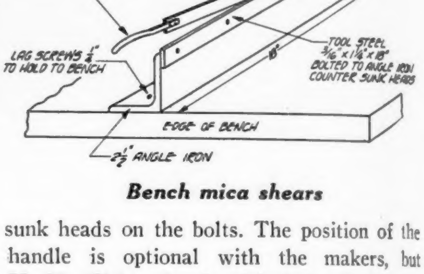
Device for producing clean stone in wet weather in position under bin gates



Method of constructing special chutes

Bench Mica Shears

THE accompanying sketch shows a bench mica shears made from a piece of angle iron and two pieces of tool steel. The construction is simple and by following the dimensions and layout on the sketch the shears may be made easily and at little cost. The holes in the tool steel should be drilled before hardening the steel and the shearing surface made smooth by the use of counter sunk heads on the bolts. The position of the handle is optional with the makers, but H. N. Kirk, who furnished the details for this device, says that he finds it much easier on the wrist to have it tip downward as shown on the sketch. Mica shears made in the above way are in use at the trimming plant of H. N. Kirk and Co., Keene, N. H.



Bench mica shears

When to Use Ball, Roller, and Plain Bearings

By W. F. SCHAPHORST, M.E.
Newark, N. J.

IT would be absurd to use ball bearings on *every* bearing simply because ball bearings run more easily than other bearings. For greatest economy shafts that are used only occasionally should usually be run in plain bearings.

If the power is turned on frequently, even though not continuously, and if electric motors are used for driving, ball or roller bearings may be better than plain bearings because the starting friction of plain bearings is high. (See chart, Column A.) On the other hand the starting friction of roller and ball bearings is not much greater than the running friction. Hence smaller motors may frequently be used with ball and roller bearings.

Where plain bearings can be kept in good condition at all times the cost of the frictional loss as compared with ball or roller bearings is often a very small item and may as well be neglected. For example, the frictional cost of running the main bearings of an engine, generator, motor, turbine, pump, and similar large units is ordinarily very small as compared with the total power involved, whereas the difference in cost between ball bearings and plain bearings is

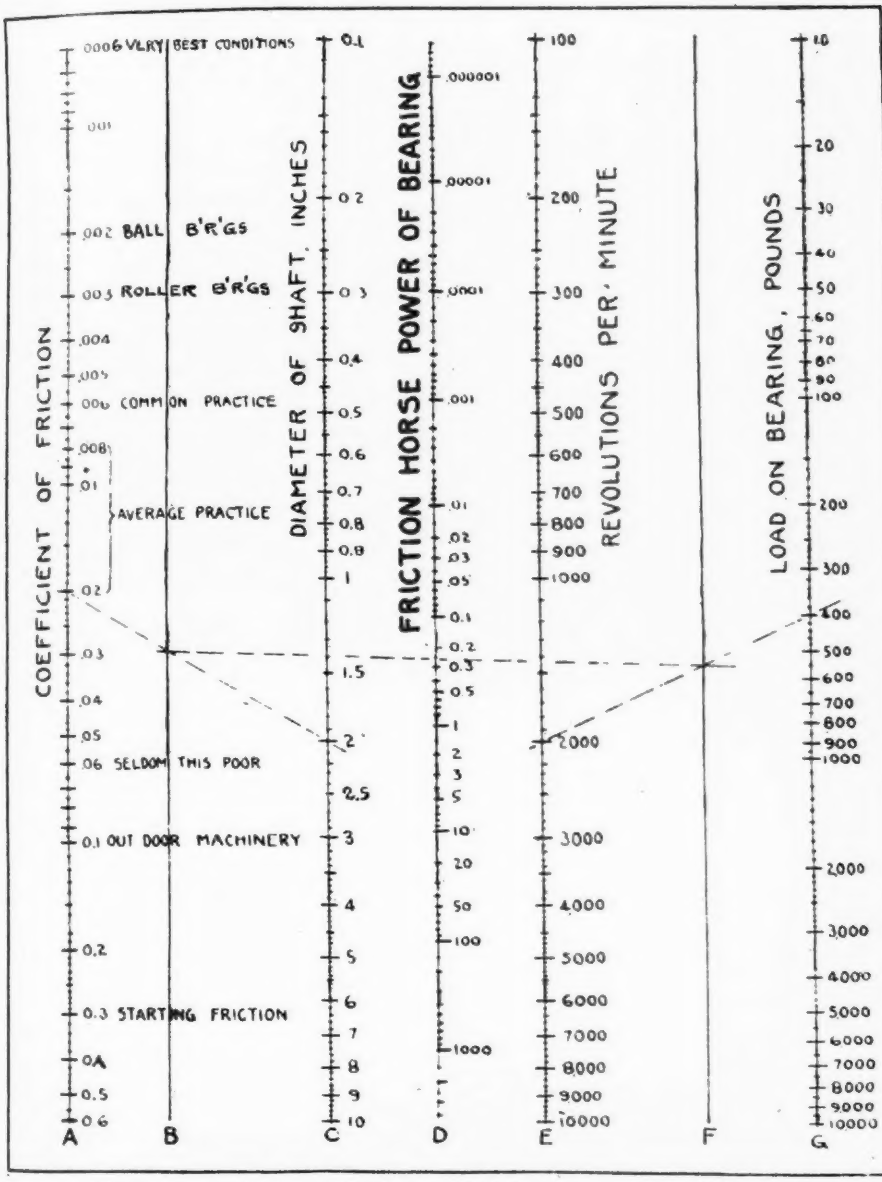


Chart for rapid determination of friction-horsepower of bearings

high. Under such circumstances, therefore, plain bearings may be more economical even though slightly less efficient. The interest on the difference in cost may be insufficient to cover the difference in the losses.

Cost Calculation

On line shafting where lubrication may be comparatively more difficult, where as a result the difference in friction may be considerable and hence the cost of power considerably less with ball or roller bearings—under such circumstances it is advisable to use the low friction type. An important advantage of roller and ball bearings is that they require less lubricant than the plain type and needn't be oiled so frequently.

In general one should ask oneself these questions: (a) What will be the total first cost with ball or roller bearings? (b) What will be the total first cost with plain bearings? (Note:—These first costs should include electric motors, generators, shafting, bearings, and everything affected by the lower power requirements of roller and ball bearings.) (c) Subtract (b) from (a). (d) Decide on a percentage, (30% is considered reasonable by some engineers) to charge against the difference in cost. This percentage must be earned annually by the saving in cost of power. (e) If the required percentage can be saved it will pay to install ball or roller bearings.

If plain bearings are now in use and it is contemplated to replace them with the ball or roller type, the labor cost of making the change must be included in the total first cost.

A Chart That Predicts Friction Horse-Power of Bearings

To use this chart, lay a straight edge across it three times, as indicated by the dotted lines, and it will give the horsepower consumed by any bearing, coefficient of friction varying from 0.0006 to 0.6; shaft diameter from 0.1 to 10 in.; r.p.m. from 100 to 10,000, and the load on the bearing from 10 to 10,000 lb.

For example, using a coefficient of friction of 0.02 (Column A), which is average practice for plain bearings, a shaft diameter of 2 in. (Column C), a speed of 2,000 r.p.m., (Column E) and a 400-lb. load on the bearing (Column G), Column D gives the friction horsepower as a little over 0.25. Connect the known value in Column A with that in Column C and locate the intersection with Column B. In the same way connect Columns E and G and locate the intersection with Column F. Then connect the intersections (Columns B and F) and the intersection with Column D gives the friction horsepower of the bearing.

Column A gives an idea as to coefficients met with in everyday practice, beginning with the very best conditions of plain bearings and ending with starting friction. Coefficients of friction under the many possible conditions are given in text-books, in Alford's "Bearings" and in such handbooks as "Kent" and Lionel S. Mark's new "Mechanical Engineer's Handbook." Only the general safe values of practice are designed on the chart herewith. As will be noted, 0.002 is used for ball bearings and 0.003 for roller bearings. All the other figures relate to plain bearings only.

Functions of the Chart

The principal function of the chart is to quicken computations and make it usable for anybody who has to do with bearings. It can, of course, be used backward as well as forward. For example, if the power absorption by a given bearing is known, and if values in Columns C, E and G are known, the coefficient of friction may be quickly determined. Then, knowing the coefficient of friction with a given oil and in a given bearing, the power required by a similar bearing of different diameter, speed and loading may be found with an accuracy sufficient for most practice.

The chart explains many things—teaches many lessons. For example, for best belt transmission practice it tells us to run belts with as little tension as possible; to run shafts at low speeds as possible; to use small shafts, preferably; to keep bearings well oiled with the proper oil, and in good condition, and it shows that ball and roller bearings are advantageous.

Rapid Method of Fixing Loose Quarry Car Wheels

By CONSOLO MERIVIGLIA
Lee Lime Corp., Lee, Mass.

THE car wheels on quarry cars are pressed on to the axles but often they jar loose and cause the car to jump off the track. When this happens, I press the wheel off about half way and prick punch the axle in 12 or 15 places, then press the wheel back in place, using a hand operated 30-ton press which I keep in the quarry. I have never had a wheel come off again which I fixed in this way and it's much quicker and easier than drilling the axle and putting in a pin, because you don't even have to take the wheel all the way off.

Economy of Waste Heat Installations in the Cement Industry*

By Otto Schott
Heidelberg, Germany

THE utilization of the waste heat of industrial kilns has made considerable progress in the cement industry within the last few years. Nevertheless, considerable heat is still lost in many up-to-date plants, escaping with the waste gases of the rotary kilns. In some instances this heat is utilized for drying purposes. The most efficient method, however, is that of utilizing it for steam generation in waste heat boiler installations. As the cost of such installations is a considerable factor, it should be worked out for each individual case. It is of particular importance in plants operated entirely by electric power where considerable new equipment is necessitated. Below are given data for three different plants operating rotary kilns.

OPERATION DATA OF THREE ROTARY KILN CEMENT MILLS

	Plant I	Plant II	Plant III
Number of rotary kilns	2	2	2
Output of kilns per 24 hr. (tons)	96	66	132
Consumption of dry pulverized coal per 100 lb. clinker (lb.)	45	26.5	25
Consumption of dry pulverized coal (lb. per hr.)	3,960	1,600	3,025
Heat value of coal used (B.t.u. per lb.)	8,600	13,100	11,860
Raw mix: Moisture (per cent)	35.5	10	0.5
$CaCO_3$ content (per cent)	77.0	76.5	77.2
Temperature of kiln gases (deg. F.)	1,022	1,472	1,112
Temperature of boiler feed water at entrance to economizer (deg. F.)	95	....	95
Temperature at economizer outlet (deg. F.)	275	212	257
Temperature of superheated steam (deg. F.)	662	572	698
Boiler pressure (atm.)	12	12	15

Plant I

The plant uses the wet process and operates by steam. The cost of production per 1000 lb. of steam produced in the present installation is about 43 cents, no account being here taken of the interest and amortization of the boiler installation.

The quantity of heat generated permits us to figure for these conditions about 11,220 lb. steam per hour, the temperature of the waste gases of the boiler being 374 deg. F. Waste heat boilers can be provided back of each kiln or a common waste heat boiler installed to serve both, for economy.

The latter case was assumed in the cost computations which follow, worked out on the basis of 6000 working hours a year:

I. COST OF INSTALLATION

a. *Machinery*

	Marks	Dollars
1. Waste heat boiler with 1000 sq. m. (10,764 sq. ft.) heating surface; 12 atm. boiler pressure	125,000	29,700
2. Feed pumps, steam and feed water piping	7,000	1,665
3. Insulation	2,300	550
4. Fan with motor drive	5,800	1,380
5. Dust collectors, etc.	8,000	1,900
6. Soot blower for boiler	5,000	1,195
7. Instruments	5,500	1,300
8. Assembly	18,000	4,280
9. Miscellaneous	17,400	4,150
Total	M194,000	$46,200

b. *Setting*

	Marks	Dollars
1. Foundations for boiler, pumps, fan	12,500	2,970
2. Masonry of boiler, economizer and dust chamber	38,000	9,050
3. Miscellaneous	5,500	1,310
Total cost of installation	M250,000	$59,500

II. COST OF STEAM GENERATION

	Marks	Dollars
1. Wages of 3 firemen at 1200 marks	3,600	860
2. Power for fan	13,200	3,200
3. Maintenance of installation, oiling, cleaning and other materials	4,000	950
4. Interest and depreciation:		
Interest:		
8% of 250,000 =	20,000	4,750
Depreciation:		
5% of 125,000 =	6,250	1,485
10% of 69,000 =	6,900	1,640
5% of 38,000 =	1,900	453
2% of 18,000 =	360	86
	35,410	8,400
5. Miscellaneous	2,090	497
Total cost of steam generation	M58,300	$13,970

III. COMPUTATION OF AMOUNT SAVED

Assuming an hourly steam consumption of 440 lb. for the feed pumps and other losses, we can figure on the basis of about 29,400 long tons of steam per year. The price being 95.2 cents per long ton, the generation of this steam costs about $28,000.

The annual saving thus amounts to: 28,000 — 13,970 = $14,030.

Plant II

This plant uses the dry process. Part of the waste heat of the kilns is utilized in drying the materials. An economizer is provided for the preheating of the feed water to a temperature of 212 deg. F.

9900 lb. steam could be generated hourly by utilizing the waste heat of the kilns for given conditions of pressure and temperature. The boiler gases, which have a temperature of 572 deg. F., can furnish the heat necessary for the drying of materials.

One common waste heat boiler is considered here for the two kilns.

The plant is steam operated. The cost of generating steam is 86 cents per long ton of steam, not taking account of interest and depreciation of the present boiler installation.

The following estimate assumes 6000 working hours a year.

COST ESTIMATE

I. COST OF INSTALLATION

a. *Machinery*

	Marks	Dollars
1. One waste heat boiler 500 sq. m. heating surface, 12 atm. superpressure with superheater, but no economizer	58,000	14,400
2. Feed pumps, steam and water piping	5,500	1,360
3. Insulation	1,500	360
4. Fan with motor drive	4,800	1,140
5. Dust collecting apparatus	5,000	1,185
6. Soot blower for boiler	5,000	1,185
7. Instruments	5,000	1,185
8. Assembly	9,000	2,150
9. Miscellaneous	8,200	1,960
	M102,000	$24,100

b. *Setting*

	Marks	Dollars
1. Foundation for boiler, pumps, fan	8,000	1,910
2. Masonry of boiler	20,000	4,760
3. Chimneys, dust chamber	12,000	2,860
4. Miscellaneous	4,000	955
	44,000	10,450
Total cost of installation	M146,000	$34,800

II. COST OF STEAM GENERATION

	Marks	Dollars
1. Wages of 3 fireman at 1800 marks	5,400	1,285
2. Power for fan	7,200	1,720
3. Maintenance of installation, oiling, cleaning and other material	2,800	670
4. Interest and amortization of invested capital:		
Interest:		
8% of 146,000 =	11,680	2,800

*Zement (1927), 22, 444-446. Note: The conversion value of one mark was taken to be 23.8c and the fractions omitted.

Depreciation:			
5% of 58,000 =	2,900		690
10% of 44,000 =	4,400		1,025
5% of 20,000 =	1,000		238
5% of 12,000 =	600		147
2% of 12,000 =	240		58
	20,820		
5. Miscellaneous	1,780		425
Total cost of steam generation	M38,000		$9,100

III. COMPUTATION OF AMOUNT SAVED

Assuming an hourly steam consumption for the feed pumps and other losses of about 180 kg., we obtain a quantity of useful heat of 25,920 long tons per year. The generation of this steam at 3.60 marks per 1000 kg. (86 cents per long ton) costs 93,312 marks or $22,300.

The annual saving thus amounts to 55,400 marks or $13,200.

These savings become even greater when the interest and depreciation of the existing boiler installation is taken into account.

Plant III

The plant uses the dry process and is entirely operated by electric power brought by a transmission line. The electric current is obtained at 4.35 pfennige (1.035 cents) per kw.-hr. A new steam power plant must be installed to make use of the waste heat of the kilns. Assuming a boiler pressure of 15 atm. and superheating of the steam at 698 deg. F., the heat of the kiln gases will yield about 11,000 lb. steam per hour.

The temperature of the boiler waste gases is in this case 392 deg. F. A common waste heat boiler is considered here and a working period of 6000 hours a year. The generated steam is to drive a steam turbogenerator. Upon subtracting the steam used by the feed pumps and for other losses totaling 440 lb., the useful steam available is 10,560 lb. per hour. The quantity would generate 800 kw., assuming a steam consumption of the turbogenerator of 13.2 lb. per kw.-hr.

COST ESTIMATE

I. COST OF INSTALLATION

a. *Machinery*

Item	Marks	Dollars
1. Waste heat boiler, 800 sq. m. heating surface, 15 atm. boiler pressure, including economizer and superheater	112,000	26,700
2. Feed pumps, steam and water piping	6,000	1,425
3. Insulation	2,000	475
4. Fan with motor drive	5,800	1,380
5. Dust arresters, etc.	8,000	1,910
6. Soot blower for boiler	5,000	1,195
7. Instruments	5,500	1,310
8. One turbogenerator, 800 kw., including assembly	115,000	27,400
9. Switchboards, connections, etc.	8,000	1,910
10. One water filter	5,000	1,195
11. Assembly of other items	14,000	3,350
12. Miscellaneous	23,700	5,670
	M310,000	$74,000

b. *Setting*

Item	Marks	Dollars
1. Foundation for boiler, pumps, fan, water purifier and turbogenerator	25,800	6,150
2. Masonry for boiler, economizer and dust chamber	30,000	7,150
3. Miscellaneous	5,200	1,240
	61,000	14,480
Total cost of installation	M371,000	$88,200

II. COST OF GENERATION OF ELECTRIC CURRENT

Item	Marks	Dollars
1. Six men (firemen and mechanics) at 1600 marks	9,600	2,290
2. Power consumed by fan	9,657	2,305
3. Maintenance of installation, oiling, cleaning and other material	7,000	1,765
4. Interest and depreciation:		
Interest:		
8% of 371,000 =	29,680	7,090
Depreciation:		
5% of 112,000 =	5,600	1,335
10% of 198,000 =	19,800	4,725
5% of 30,000 =	1,500	358
2% of 31,000 =	620	148
Total int. and depr.	M57,200	$13,620
5. Miscellaneous	2,543	600
Total cost of current generation	M86,000	$20,500

The power for condensation may be assumed to be 20 kw., so that the useful power is 780 kw. If 6000 working days a year may be assumed, the cost of generated current is:

$$\frac{86{,}000\text{ M.}}{780\times6000} = 0.0184\text{ M. or } \frac{\$20{,}500}{780\times600} = .044\text{ c.}$$

As the plant requires a total of 1300 kw., an additional 520 kw. must be purchased as before. The economy of the waste heat installation thus depends upon the price for which this additional electric current may be obtained in reduced amounts. Assuming a high value of 0.06 mark (1.428 cents), we can figure the saving achieved.

Former cost of electric current a year:
$1300 \times 6000 \times 0.0435 = 339{,}300$ M. ($81,000)

Cost of current generated above in waste heat boiler installation........ 86,000 M. ($20,500)

Cost of power to be purchased as before:
$520 \times 6000 \times 0.06 = 187{,}000$ M. ($44,600)

The annual saving is thus .... 66,100 M. ($15,800)

Due to certain unavoidable disturbances a slightly higher current consumption will be actually observed. The additional cost cannot be considered here.

There is still the possibility of generating the remaining 520 kw. in the waste heat boiler installation by providing it with pulverized coal firing. The plant would then furnish the entire 1300 kw. required. The steam turbogenerator would have to be selected with this in mind. In this case a reserve reservoir would have to be installed to make the plant entirely independent in its supply of power. The total cost of such an installation, however, would be considerable, so that one might hesitate at investing so much capital. Nevertheless, it remains true that this plant would derive great benefits from its waste heat, as the price of the bought current, 4.35 pfennige (1.035 cents) per kw.-hr. is high.

The Marguerre process has been successfully used for the same purpose. As yet it lacks the support of operation data extending over long periods of time. The utilization of waste heat in accordance with this process reduces the cost of installation, although its cost of maintenance and operation is somewhat higher.

Effect of Various Gases on Types of Refractories

THE experimental work on the color changes and physical and chemical alterations that take place in various refractories as a result of the action of different gases was completed in 1922 under the direction of R. M. Howe. His results, however, have just been published in Bulletin No. 9 of the American Refractories Institute. The conclusions drawn are sure to be of interest to cement, lime and other manufacturers who use refractory linings which are exposed to gases such as SO_2, CO and Cl.

The refractories under investigation were classified as follows: Magnesite, chrome, diaspore, low iron clay, high iron clay and silica. Test cubes of these were exposed to the action of sulphur dioxide, carbon monoxide and chlorine gas for 72 hours at temperatures of about 950 deg. C. Color changes were observed and cold crushing tests after the gas treatment run on a number of the cubes.

Very little change in composition was observed to result in most of the cases because of the gas treatment. Color changes were produced through the reduction of the iron compounds and this cannot be determined except by special analytical methods. In the case of chlorine-treated chrome, a great difference of composition resulted due to the volatilization of the chromic chloride. Analysis shows the residue to be high in iron, a fact quite inexplainable. Chlorine was found in a high percentage in the chrome sample and to a lesser degree in the magnesite. The silica contained an appreciable quantity also. Sulphur compounds were not found to any extent except in the magnesite sample.

The different refractories exhibited marked changes in crushing strength after the gas treatment. Increases of strength were noted for magnesite and chrome refractories after the sulphur dioxide treatment. Carbon monoxide lowered the strength of all the refractories, silica, chrome and low iron clay being the most affected. Chlorine also lowered the crushing strength, magnesite and chrome dropping off about 100%. In all cases the strength of the diaspore refractory was the least affected by any of the gases.

Burning of Lime in Tunnel Kilns

Report of Large Scale Tests Carried Out in Germany—A Specially Designed German Tunnel Kiln

By Walter Pohl

Director, Keramische Industrie—Bedarfs—Aktiengesellschaft, Dresden, Germany

ALTHOUGH within the last few years the tunnel kiln has been steadily widening its field of application in ordinary and fine ceramics, its use for lime burning has been studied but little. As it has considerable advantages over other types of kiln, it is a matter of wonderment, why no such kilns are as yet being built by the lime industry.

Lime is now being burned in shaft, rotary and ring kilns.

Kiln Types

The shaft kiln of modern design, with gas firing and built for large capacity works rather economically and has a low fuel consumption. Its main disadvantages are:

1. Heavy wear on the refractory lining of the kiln.
2. Difficulty in obtaining large lump lime as the discharging mechanism in use on most kilns breaks up the material.
3. Impurities in the lime due to the slag formed by the fuel.

Fig. 1. Limestone piled on tunnel kiln car before calcining illustrating the direct method of piling

The ring kiln has the following disadvantages:

1. Its operation is costly, as the lime must be transported to and from the kiln, the latter thus hardly corresponding to an extensively automatic operation.
2. High coal consumption.
3. Impurities in the lime due to the slag.

On the other hand, the tunnel kiln offers the following advantages:

Advantages of Tunnel Kiln

1. Low cost of labor and raw material transportation.
2. Low coal consumption, as the operation is continuous and allows the most efficient utilization of all sources of heat.
3. Exceptionally long wear of the refractory lining.
4. Facility of control and regulation of the burning process.
5. High temperatures in the burning zone.
6. Large capacity.
7. Production of large lump lime, free from usual contaminations.

A kiln of this type is of interest to all lime manufacturers throughout the world. Wide circles will, therefore, be interested in the following report on experiments made in a tunnel kiln in Germany on the burning of lime in such a kiln. The tests were made during 1923 through the initiative and under the direction of the heat economy committee of the German Lime Association.

The Saarau Co. manufacturers of refractories placed a tunnel kiln at the disposal of the lime association for the purpose of tests. This kiln had been used for firing fireproof brick and forms for the ceramic, glass and steel industries. It was built in 1911 and in some respects could not measure up to the standards of the more recently built European tunnel kilns.

The dimensions of the kiln were: length 60 m. (200 ft.); width of burning zone—1.50 m. (5 ft.); available loading width—1.40 m. (4 ft. 8 in.); available loading height from the platform of the trucks to the top of the kiln—1.60 m.; length of the trucks—1.65 m. (5½ ft.). Each truck thus had a loading capacity of 2.8 cu. m. (about 3¾ cu. yd.).

The kiln consisted of three sections: the

Fig. 2. Another method used of piling the limestone on the cars—the stone resting on a refractory brick base

preheating zone, the *burning* zone and the *cooler*. The water mechanically and chemically combined was driven off from the previously dried refractories in the preheating zone and the charge preheated to 1150 deg. C. Further heating of the charge to 1350-1400 deg. C. took place in the burning zone. The charge was allowed to remain in the zone of highest temperatures for about five hours to secure thorough firing even of the large refractories. Thirty-six trucks, forming a continuous chain, stood in the interior of the kiln. Their movement was controlled by an electric device, which forced the entire line of

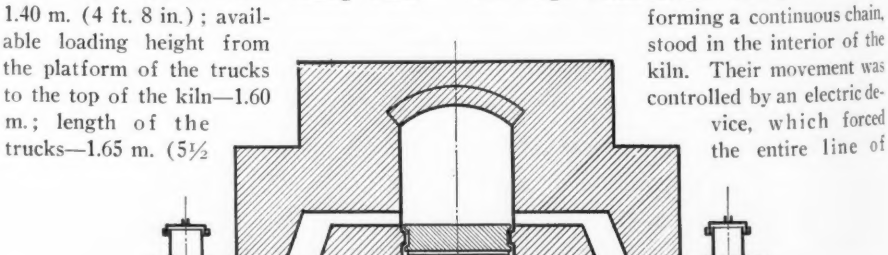


Fig. 3. Cross section through the burning zone of a ceramic kiln used for burning lime

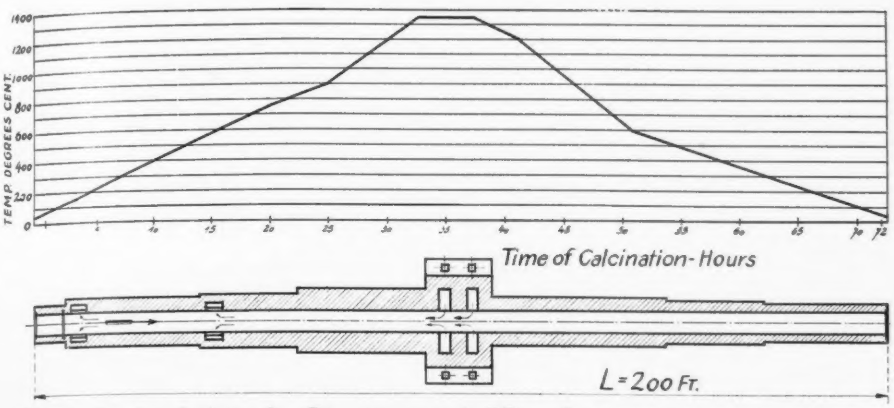


Fig. 4. Sectional view of a German ceramic kiln—the temperature curve above is plotted to correspond with kiln positions. This kiln with modifications could be used for burning lime

trucks through the kiln. A double door, provided at the entrance of the kiln, prevented the outside air from penetrating into the kiln, so that neither the draft nor the flue gases from the burning zone could be influenced by outer currents. A swinging door closed the discharge end; the double door arrangement was unnecessary at this point, as the cooling zone had sufficiently high pressure to prevent any suction of cold air from the outside.

Kiln Operation

The kiln was gas fired, the gas being produced by four generators built immediately next to the kiln and arranged two on each side and in the exact center of the kiln. Fig. 3 shows a section through the burning zone. The gas generators are fired with Silesian coal, stoking taking place every two hours in such a manner that one generator is charged every half hour. The gases are admitted directly into the interior of the kiln after becoming mixed with preheated air. This produces extremely high temperatures in the burning zone. The hoppers charging the generators are built right next to the masonry of the kiln. This arrangement has proved to be very practical, as the heat liberated during gas production is not wasted, but put into the kiln by the gas.

The heating gases are admitted to the tunnel kiln directly above the platform of the truck and penetrate the charge through slits left between the refractories. Due to the special design of the kiln arch in the preheating zone the entire truck load becomes uniformly heated so that no underburned material is obtained.

This kiln was used in 1923 for both the preliminary and actual tests. The material at hand was a coarse limestone which retained its shape throughout the calcination process. The first test trucks passed through the kiln without any friction at a temperature of 1350 deg. C. Seventy-five tons of limestone were on hand for the main tests. The rock was loaded on the trucks as shown in Figs. 1 and 2. Two kinds of loading were tested: one set of trucks received a direct load of limestone, while another had refractories piled on the outside to conduct the heat to the inner portion of the load.

Twenty-three trucks were loaded with 75 tons of limestone, each one receiving a load of 3½ tons. These trucks were then pushed into the kiln. At intervals of two hours the line of trucks was moved up one truck. This period of time corresponded approximately to a kiln output of 42 tons lime per 24 hours. The fuel consumption during the test period was established as 15.5%, computed per unit of weight of burned lime and assuming a heat value of 11,800 B.t.u. per lb. of coal.

All 23 trucks passed through the kiln undisturbed. Representatives of the heat economy committee of the Association of Lime Manufacturers were present at the unloading of the trucks. The burned lime retained its lump form and had a pure white color.

The results of these preliminary tests were extremely good for a kiln of old design. With the exception of a relatively low percentage, the lime was burned uniformly. The slightly underburned lime was found in the center of the load near the truck platform. This was due to the more or less obsolete design of the gas producers, which did not furnish a sufficient flame to penetrate the mass, particularly as no channels were left in the load, but the lime was piled without leaving free spaces. Neither did the load come close to the roof of the

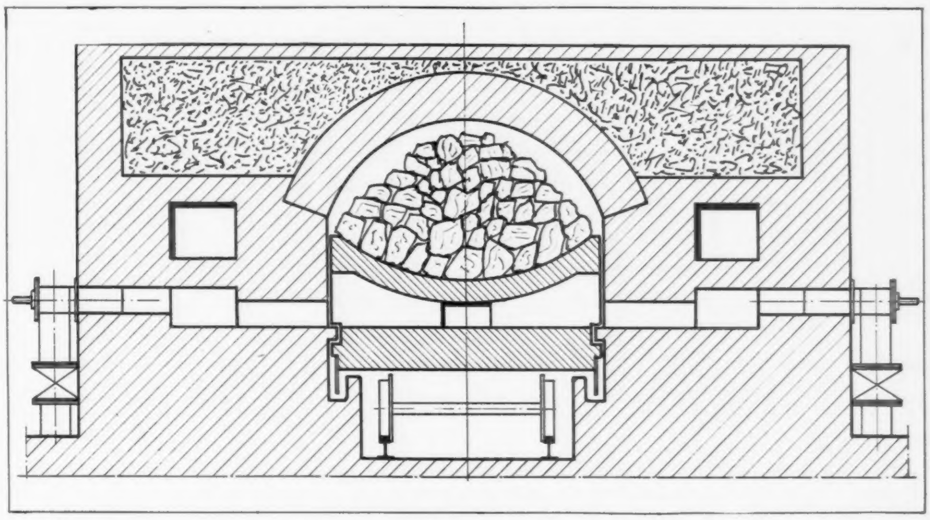


Fig. 6. Cross section of a proposed tunnel kiln for burning lime, showing the position of the car. Note the type of car construction

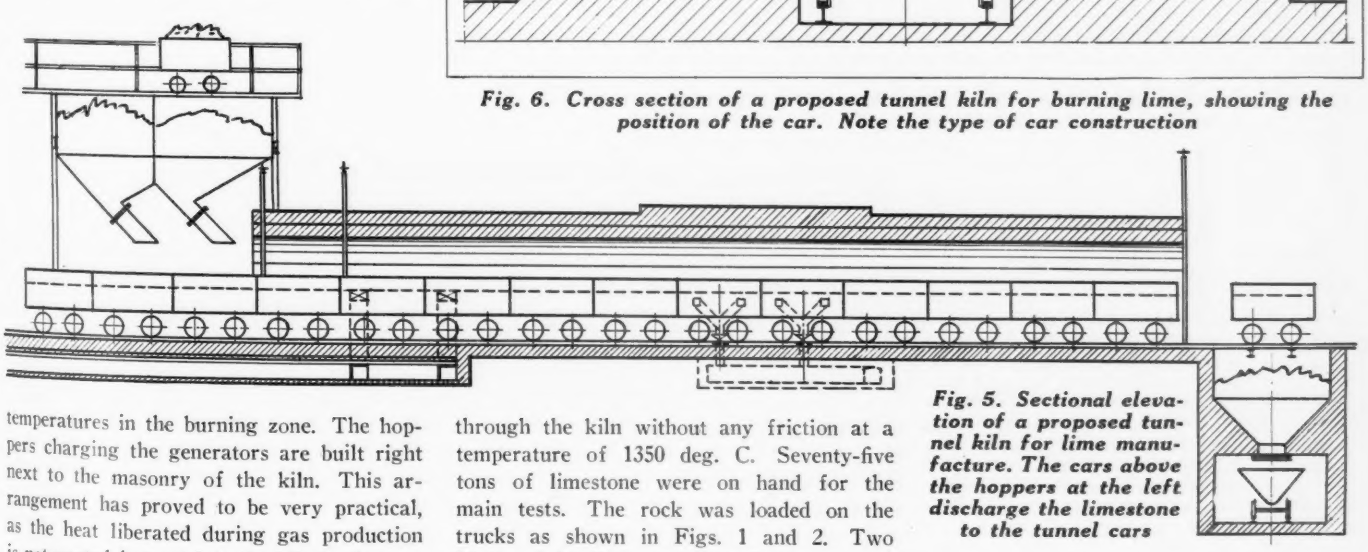


Fig. 5. Sectional elevation of a proposed tunnel kiln for lime manufacture. The cars above the hoppers at the left discharge the limestone to the tunnel cars

kiln, as is the case in all kilns of Saarau design, so that part of the hot gases reach the flues without penetrating the charge. It is clear that the load of limestone could not be arranged to fit the kiln cross section as well as the load of refractories. This is illustrated on Fig. 3.

Requirements of Tunnel Kiln for Efficient Operation

Fig. 4 shows the main dimensions of a Saarau kiln. Above it is shown the temperature curve for this type of kiln operating normally. A tunnel kiln designed for lime burning should have a considerably longer preheating zone, so that complete burning of the limestone is assured. The cooling zone should be considerably shorter than that of the Saarau kiln. The main requirements should be:

1. Completely automatic operation of the entire installation.
2. Large capacity, as only large capacity makes a tunnel kiln economical.
3. Guaranteed uniform burning of the charge and avoiding of an ash coating.
4. Low fuel consumption.

All these requirements can be satisfied. The Ceramic Industry Equipment Co. in Dresden, Germany (Keramische Industrie-Bedarfs-Aktiengesellschaft) for many years has been building tunnel kilns for the most varied uses in that industry. It has worked out a design of a tunnel kiln burning lime most economically or calcining flint.

Fig. 5 shows a drawing of this tunnel kiln. It consists of five zones.

1. The loading zone.
2. The preheating zone.
3. The burning zone.
4. The cooling zone.
5. The unloading zone.

The limestone is not sorted, but dumped into silos from cars bringing it direct from the quarry. The trucks are loaded from these silos automatically, each one receiving a charge about 1 m. high. By regulating the hopper discharge, the loading of the entire line of trucks is made to correspond to their movement through the kiln.

The pushing of the trucks also proceeds automatically by means of an electric device; this movement is continuous so that no interruption occurs in either the loading or unloading operations.

The preheating zone should be designed long enough to assure thorough burning of the limestone. The trucks are provided with a conical pile of refractories arranged in a manner allowing the gases to penetrate uniformly through the entire charge.

The design of the burning zone of this kiln is shown in Fig. 6. It is assumed that the kiln is fired with natural or producer gas. The gas is admitted from both sides of the kiln into a mixing chamber of special design, in which the gases are mixed with the air supply preheated to high temperature. The mixed flame enters through channels in the truck platform and produces an extremely high temperature insuring also uniform burning of the lime. The burning zone must be of sufficient length, which depends on the capacity of the kiln and on the temperature required for burning. Four, six or eight gas inlets should be provided on each side of the kiln, according to its capacity.

A similar design is used for kilns burning oil as fuel. Oil spraying nozzles are provided instead of the gas inlets, and the mixing chamber is replaced by a combustion chamber in the kiln masonry on the side of the kiln.

The cooling zone may be relatively short, as limestone is not sensitive to rapid cooling. Upon leaving the kiln, the trucks discharge into bunkers, from which the lime is drawn directly for shipment. Even a large capacity kiln of this type requires normally but two or at most three men for its operation under proper management.

In summing up the foregoing, one may state that the carefully carried out tests on burning lime in a Saarau kiln have shown that tunnel kilns can be adapted to the burning of limestone. The shaft kiln will probably be retained for small scale production, as it is cheaper and its operation is simple. For medium and large scale production, however, the tunnel kiln can be operated economically.

The author hopes that the present discussion of the tunnel kiln may bring new suggestions on this subject and is of the opinion, that taking into account present economic conditions, American manufacturers are in a better position than European manufacturers to build a tunnel kiln of large capacity for the burning of lime.

Production of Feldspar in 1926

THE crude feldspar sold or used by producers in the United States in 1926 amounted to about 209,600 long tons, valued at about $1,607,000, or $7.67 a ton, according to reports obtained directly from producers by the United States Bureau of Mines, Department of Commerce, in cooperation with the geological surveys of Maryland, New York, North Carolina and Virginia. These figures show an increase of 13% in quantity and 22% in total value compared with 1925, and represent the largest production and value ever recorded. Feldspar was mined and sold in 1926 in 12 states, namely, Arizona, California, Colorado, Connecticut, Maine, Maryland, New Hampshire, New York, North Carolina, Pennsylvania, South Dakota and Virginia. The greatest feldspar-producing region is that which includes the Atlantic seaboard states, from Maine to North Carolina. This region reported about 93% of the total production and value in 1926. North Carolina, the leading state, reported about 44 per cent of the total output; Maine, the second state by a very small margin, reported slightly more than 16%; and New Hampshire, the third state, nearly 16%. The average value per long ton in North Carolina was $6.59; in Maine, $9.07; and in New Hampshire, $8.66.

Except for minor purposes, feldspar is prepared for use by grinding. This work is done principally by commercial mills; only a very small portion is ground by users in their own mills. In 1926 there were 29 commercial mills operated in 13 states, namely, California, Colorado, Connecticut, Illinois, Maine, Maryland, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania and Tennessee. These mills reported 225,362 short tons of ground feldspar sold in 1926, valued at $3,775,797, or $16.75 a ton, compared with 212,858 tons, valued at $3,603,845, or $16.93 a ton, in 1925, an increase of 6% in quantity and 5% in total value. Of the quantity sold in 1926, 199,215 short tons, valued at $3,246,174, or $16.29 a ton, was domestic feldspar, and 26,147 tons, valued at $529,623, or $20.26 a ton, was Canadian feldspar. Canadian feldspar was ground in three states in 1926—New Jersey, New York and Ohio. These figures represent increases in production and value of domestic feldspar and decreases in Canadian feldspar as compared with 1925.

The production of crude feldspar by states in 1925 and 1926 is shown in the following table.

CRUDE FELDSPAR SOLD OR USED BY PRODUCERS IN THE UNITED STATES

State	1925 Long tons	1925 Value†	1926* Long tons	1926* Value†
Arizona	(‡)	(‡)	(‡)	(‡)
California	6,077	$49,881	6,200	$49,300
Colorado	(‡)	(‡)	(‡)	(‡)
Connecticut	10,426	71,201	11,400	87,800
Maine	28,404	256,731	33,800	306,600
Maryland	4,554	26,438	(‡)	(‡)
N. H.	38,366	278,736	33,200	287,500
New York	10,474	70,446	15,500	157,800
No. Car.	76,806	496,563	91,400	602,000
Penn.	1,330	4,722	(‡)	(‡)
So. Dak.	(‡)	(‡)	(‡)	(‡)
Virginia	(‡)	(‡)	(‡)	(‡)
Undistrib.	9,269	60,936	18,100	116,000
	185,706	$1,315,654	209,600	$1,607,000

*Figures for 1926 are preliminary and subject to revision.

†Value at mine or nearest shipping point.

Quarry Problems in the Lime Industry

A NEW Bureau of Mines bulletin, No. 269, contains a rather comprehensive discussion of the problems in limestone quarrying. These problems, of which stripping, blasting, utilization of waste rock are typical examples, are covered in detail and some general operation methods discussed critically in an effort to elucidate best working principles. It is hoped that it will be of assistance to lime manufacturers in correcting errors and establishing their industry on a more economical and efficient basis. The authors are Oliver Bowles and W. M. Myers. Copies are available at 25 cents each from the Superintendent of Documents, Washington, D. C.

Air Separation Methods Used in Fine Grinding of Rock Products

V.—Other Types of Separators Using Fans and Vanes, with a Rotary Feed Disk

By Edmund Shaw
Editor, Rock Products

The Kent Mill Co.'s Separator

The Kent Mill Co.'s air separator has an interior fan and the outside appearance resembles that of other air separators but the resemblance ends with these points. It is in no sense a development of the Pfeiffer, Emrick and other early forms because it does not employ the centrifugal force of a whirling body of air as one of the two components by which the resultant separation is secured. There is a centrifugal feed disk but this is merely to spread out the material so that a rising current of air may act on individual grains.

This machine was introduced in what is practically its present form in 1918. It is of especial interest to the rock products industries because it is in these that it has found its widest field, being mainly employed in the grinding of gypsum and phosphate rock. One gypsum company has 22 of these machines in use and the makers say that about 180 machines are used in the rock products industry.

As in some other separators the feed comes in through a tube inside a hollow shaft and falls on a revolving feed disk. This spreads the feed out and throws the heavier particles to the wall of an inner shell where they roll down to the coarse product discharge. A current of air rises through the feed as it is spread out and picks up the lighter particles and carries them to the outer shell where they fall to fine product discharge. The air is passed through a series of deflector blades at the bottom of the inner shell. These deflector blades do *not* impart a whirling motion to the air. In fact they are constructed with the idea of killing any such motion. The blades are narrow and half round in shape and set staggering. The air trying to find its way through them is thrown into a multitude of little eddy currents which cause the fine particles to drop out and fall to the side of the outer shell so that they roll down to the fine product discharge.

Since a machine of this type does not employ centrifugal force as one of the component forces which make the separation, the speed of the fan is an important factor. The higher the speed the greater the lifting force that the fan will have and hence the coarser the grains that will go into the outer shell and drop to the fine product discharge.

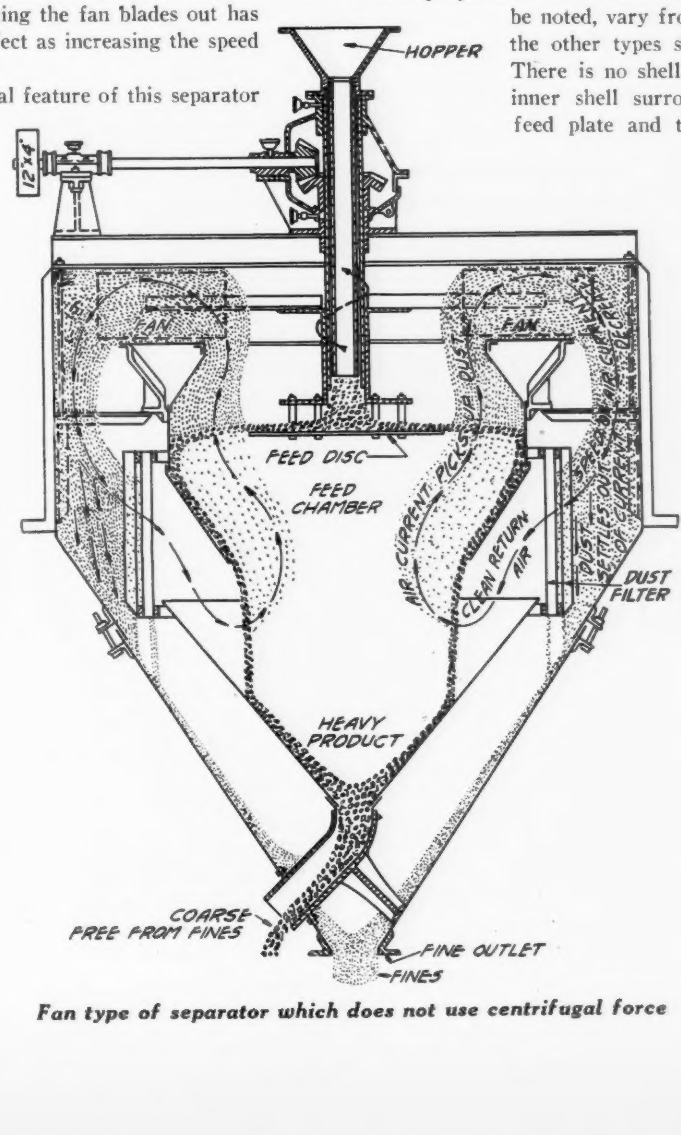
A second adjustment is provided however and this can be made more easily than the change in speed, which might require the changing of pulleys under ordinary plant conditions. This adjustment is the position of the feed disk. The nearer the plate is brought to the fan the coarser the grains that will be lifted by the fan and sent into the outer shell. With varying the speed and varying the position of the feed disk, the separation can be changed through a wide range of mesh sizes. An additional adjustment is that of the fan blades which may be set in or out. Setting the fan blades out has the same effect as increasing the speed of the fan.

An unusual feature of this separator is the small amount of power used, only 3 hp. being required to run the largest size machine. The machine is made in sizes from 9 ft. to 12 ft. in diameter. The ordinary speeds of the drive shaft are between 230 and 260 r.p.m.

The Sturtevant Separator

The Sturtevant air separator, made by the Sturtevant Mill Co., Boston, Mass., is a development from earlier types and its present form is the result of a long course of experimentation. Separators were built and rebuilt, changing proportions and dimensions and working to an efficiency curve.

The proportions of the inner shell, it will be noted, vary from some of the other types shown here. There is no shell within the inner shell surrounding the feed plate and the plate is



Fan type of separator which does not use centrifugal force

set closer to the fan than in some other models.

A hollow shaft is not used for delivering the feed to the centrifugal feed distributing plate; the feed falls in a hopper and thence goes to a casing surrounding the main shaft. From this casing it falls through ports into a mixing and feeding device, which breaks up lumps and mixes fine and coarse. Then it goes to the distributing plate, where it is whirled and spread out by centrifugal force. The distributing plate has a series of ribs so that the feed passing over it rubs on a bed of material and this keeps down the abrasion on the plate.

There is a baffle above the distributing plate so that all the material has to pass around it to get to the fan. Above this is one of the distinguishing devices of this type of separator, a diaphragm shutter, very much like a camera diaphragm, composed of a series of overlapping plates. These may be moved by rods which pass through the outer shell, thus varying the outlet size.

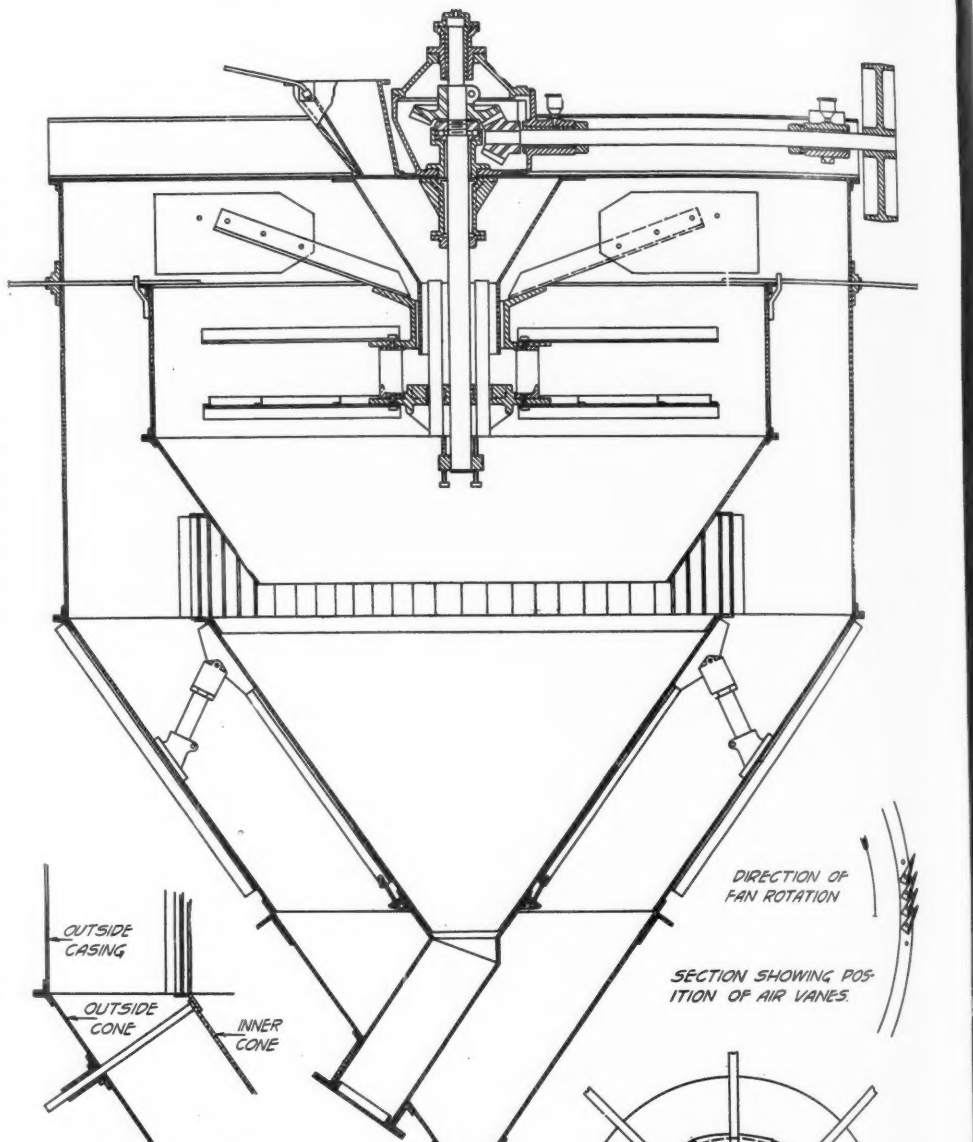
Reference to Fig. 8 showing the line of separation as a resultant of the horizontal centrifugal force and the vertical lifting force, coming from the suction of the fan, will show the purpose of this variable outlet. Closing and opening this outlet varies the volume of air passing to the fan above and hence varies the lifting effect of the air. The centrifugal force of course remains constant, the speed being unchanged. As one component of the resultant is changed while the other remains constant, the resultant changes its position and the separation effective on different grain size.

The whirling action on the body of air in the inner shell is effected by vanes at the bottom of the shell. These are adjustable, but this movement is not an operating adjustment.

There are thus three operating adjustments by which the product may be varied. The main one is the "outlet valve," as the makers call it, the diaphragm shutter just described. The feed plate may be made large or small, thus varying the force with which it throws the feed to the inner shell, and the speed may be changed which has a slight effect on the size of the finished product.

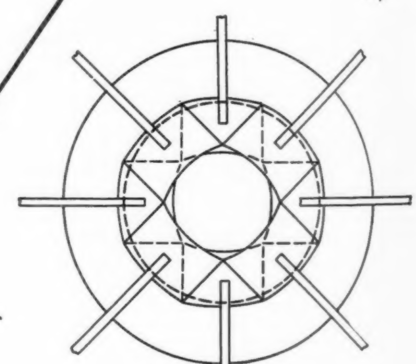
The manufacturers recommend the air separator for all separations coarser than 50-mesh and say that it has been successfully used for separations as coarse as 30-mesh. They state that on average materials and under average conditions the fine product will run from 95% to 98% finer than the mesh separation decided upon and from 77% to 95% of oversize in the coarse product which is returned to the mill. This variation depends upon the character of the material treated as well as the fineness of the mesh size on which separation is made.

This separator is made in sizes from 3 ft. to 14 ft. diameter and the horsepower required is from ½-hp. to 18-hp., according to the size. The ordinary speed is about 200 r.p.m. for the fan.



SECTION SHOWING TAPPER RODS

Valves below the inner shell and a shutter diaphragm above regulate the size of product



CONSTRUCTION VALVES
VALVES ARE SHOWN IN CLOSED POSITION

This machine is said to be successful in handling moist materials. The difficulty that might come from these materials sticking to the side of the inner shell is overcome by having tapper rods projecting through the outer shell. Rapping these dislodges any accumulation on the inner shell.

A recent type of this machine has been built especially to handle freshly ground hot cement clinker which may have a temperature of 300 deg. F. This type has ball bearings which are unaffected by such a temperature and renewable lining of a material that will resist abrasion well. The machine is also designed to serve as a cooler, reducing the temperature of the hot cement at least 100 deg. and thus bringing it to a temperature at which it may be sacked immediately without the necessity of putting it in storage to cool.

In grinding clinker the makers claim an improvement in capacity of the tube mill from 25% to 62%. In addition, the fineness being predetermined, the cement is uniformly ground without careful regulation or attendance.

This machine has a wide use in the rock products industries, being used in the grinding of limestone, talc, feldspar and phosphate rock. Recently, several installations in cement plants have been made.

The illustrations in the first article of this series show actual installations of Sturtevant separators in various kinds of rock products grinding.

Huron Portland Launches Third Bulk Cement Carrier

A THIRD bulk cement carrier was added to the fleet of the Huron Portland Cement Co. of Detroit, Mich., the pioneer in bulk cement transportation on the Great Lakes, when the *S. T. Crapo*, the largest self-unloading bulk cement freighter on the Great Lakes, was launched on July 7 at the Great Lakes Shipyard, at Ecorse, on the Detroit river. This new ship will be engaged exclusively in carrying Huron portland cement for the company's plants at Alpena, Detroit and Wyandotte, Mich., Duluth, Minn., Milwaukee, Wis., Cleveland, Ohio, and Buffalo, N. Y.

The other ships in the fleet which the *Crapo* joins are the *John W. Boardman* and the *Samuel Mitchell* all transporting bulk cement for the company's plants on the Great Lakes.

The fine new carrier, built at a cost in excess of $1,000,000, is named for Stanford T. Crapo, secretary-treasurer of the Huron company. It carries 7500 tons of bulk cement, equivalent to 160,000 sacks, and a capacity cargo can be taken on in four hours and discharged in 10 hours by its self-unloading equipment without any aid from unloading equipment on the dock.

The over-all length is 400 ft., with a depth of hold of 29 ft. and a beam of 60 ft. The unique self-unloading equipment was built according to designs by the company's own engineers.

Power is furnished by three 2000 horsepower Scotch marine boilers and triple expansion engines, and the running speed is 13 miles per hour. The electrical equipment includes three turbo generators. The operating crew is 35 men.

One of the unusual features of the launching was the fact that smoke issued from the stack of the *Crapo* as she slid down the skids into the slip at the shipyard where she was built. The boilers had already been fired and blasts from the new whistle answered the salutes of other craft attracted to the vicinity by the launching.

The Huron Portland Cement Co. chartered the passenger steamship *Wauketa* to conduct a launching part of over 600 guests to the scene of the launching. A large number of spectators also gathered on shore.

Miss Anita Boardman, daughter of John W. Boardman, vice-president of the Huron company, was sponsor and christened the new ship as she slid from her ways.

The christening party included John B. Ford, president of the Huron company; John B. Ford, Jr., Fred Ford, John W. Boardman and other officials of the Huron company, and W. W. Crapo, son of S. T. Crapo, after whom the ship was named.

In addition to the christening party, the *Wauketa* carried a number of officials from various parts of the state and adjoining states. Among these were B. F. Affleck, president of the Universal Portland Cement Co.; George S. Bartlett, also of the Universal company, Chicago, Ill., and William M. Kinney, general manager of the Portland Cement Association.

The S. T. Crapo, the newest bulk cement carrier of the Huron Portland fleet

Luncheon was served to the guests on the *Wauketa* and there was dancing aboard.

From the Ecorse shipyards the launching party sailed to the cement company's private dock at Wyandotte for an inspection of its Wyandotte plant, and then returned to Detroit. The new cement mill at Wyandotte has recently been completed.

Dwight Morgan Manager of Virginia Portland

DWIGHT MORGAN has been appointed vice-president and manager of the Virginia Portland Cement Corp. of Norfolk, Va. Mr. Morgan is a brother of E. S. Morgan of Dallas, vice-president of the Texas Portland Cement Co.

He left Dallas in 1925 to become sales manager for the Virginia cement concern, then newly organized as a subsidiary of the International Portland Cement Corp. He remained in charge of sales until his promotion to the post of vice-president and manager. Mr. Morgan was formerly connected with the Texas Portland Cement Co. of Dallas.—*Dallas* (Tex.) *News*.

New Two-Kiln Australian Cement Mill

THE Southern Portland Cement Co., Ltd., Sydney, Australia, which is constructing a new two-kiln cement mill at that place, expects to start operations about December, 1928, according to a communication from Allen Christie, secretary of the company. The capacity of the plant is said to be about 800,000 bbl. per year.

An earlier report published in the May 14 issue of ROCK PRODUCTS was erroneously interpreted with regard to production and operation date. This in its correct form refers to the production of the Southern Blue Metals Quarries, Ltd., which commenced operations in June.

F. W. M. Hammerschmidt

F. W. M. HAMMERSCHMIDT, known as "Max" Hammerschmidt to his many friends, died at the home of his son, Alvin, in Elmhurst, Ill., June 27, after an illness of some years' duration. He was 62 years of age.

Mr. Hammerschmidt belonged to a family that is very well known in the rock products industries. He was born in Naperville, Ill., and was graduated from the academy of Northwestern College there. After his father founded the Elmhurst Stone Quarry, the son became its manager, eventually joining with his brothers in the conduct and ownership of the business. His older brother, William, died about three years ago and another brother, Richard, is president of the present company.

Mr. Hammerschmidt continued his connection with the quarry business until 1922 when failing health forced him to retire. During all the years that he was able, he was as active in the affairs of his town as he was in those of his business. He was an organizer and director of the First National Bank of Elmhurst, secretary of the board of education and an organizer and the treasurer of the Elmhurst Electric Light and Power Co. For eight years he was mayor of Elmhurst and gave unsparingly of his time and strength to better the town and solve the problems that came with its rapid growth. He was long a member of the Masonic fraternity and one of the first to join the Elmhurst Golf Club.

He was married in 1890 and his wife died about seven years ago. Three children survive him.

A very successful shot. Note how the rock slid away from the face to form a uniform pile

One end of the pile taken close to show that the rock was well broken up by the blast

Blasting Methods of Texas Trap Rock Corp.

Use of the Coyote Hole Gives a High Recovery with a Low Cost of Placing the Explosive

THE Texas Trap Rock Corp. of San Antonio, Texas, operates a quarry at Knippa, which is 80 miles west of the city. The trap rock quarried is basalt and it has the columnar structure which basalt often shows. At Knippa is one of the three places in the state where basalt is found in workable height and area, one of the others being the well-known landmark called Pilot Knob. These basalt formations are supposed to be extrusions of lava-like material that were probably thrown out while the surface was covered by the sea. The columnar structure came from the stresses formed by sudden cooling.

Such a structure will shatter with the proper kind of blasting, even though the rock itself is very hard. Texas trap rock crushes at about 40,000 lb. per square inch, which makes it especially valuable for railroad ballast and material for certain kinds of roads. Much of the product of the Texas Trap Rock Corp. is sold for railway ballast, although a large part of the production is concrete aggregate.

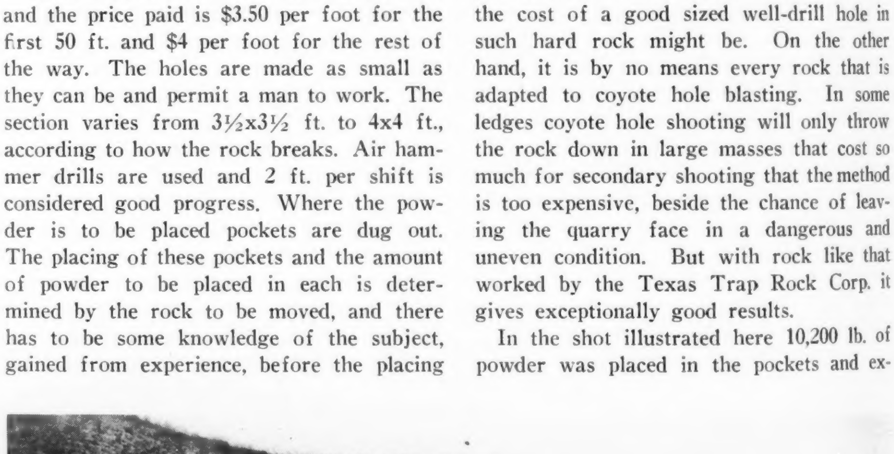
The coyote hole method has been found the best for blasting, in that it requires a less expense for placing the powder than well drilling and it gives an excellent recovery of broken rock for the powder used. The face of the quarry is 60 to 100 ft. high, according to the place on the hill where the measurement is made. It is about 100 ft. above the quarry floor to the top at the point where the shot was made which is illustrated in the photographs.

Experience has shown that a coyote hole will be economical with about 50 ft. of burden, in this rock. The first working was therefore to put in a hole at right angles to the face for about that distance. It measured exactly 52½ ft. to the end. Then two laterals were driven for about 60 ft. each way, following the face so that the burden would be equally distributed. The condition of the upper part of the face determined this, for where the face slants back the burden can be greater than where it is perpendicular all the way.

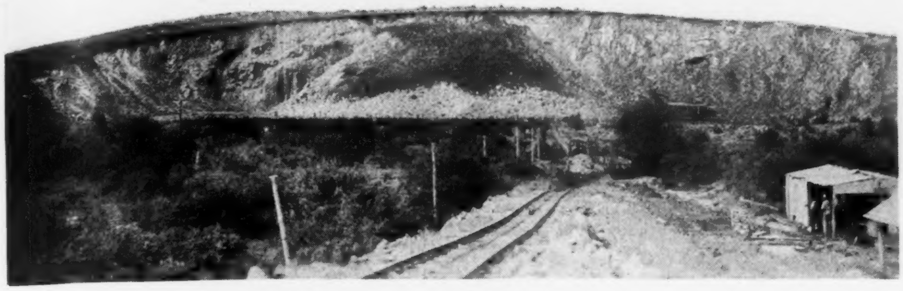
These coyote holes are driven by contract and the price paid is $3.50 per foot for the first 50 ft. and $4 per foot for the rest of the way. The holes are made as small as they can be and permit a man to work. The section varies from 3½x3½ ft. to 4x4 ft., according to how the rock breaks. Air hammer drills are used and 2 ft. per shift is considered good progress. Where the powder is to be placed pockets are dug out. The placing of these pockets and the amount of powder to be placed in each is determined by the rock to be moved, and there has to be some knowledge of the subject, gained from experience, before the placing of the pocket and the size of the charge can be properly calculated.

If the rock is of such a nature that coyote hole shooting is effective, it can be seen that the preliminary work is cheap, since the per foot cost of the coyote hole is less than the cost of a good sized well-drill hole in such hard rock might be. On the other hand, it is by no means every rock that is adapted to coyote hole blasting. In some ledges coyote hole shooting will only throw the rock down in large masses that cost so much for secondary shooting that the method is too expensive, beside the chance of leaving the quarry face in a dangerous and uneven condition. But with rock like that worked by the Texas Trap Rock Corp. it gives exceptionally good results.

In the shot illustrated here 10,200 lb. of powder was placed in the pockets and ex-



The quarry face shows a marked columnar structure which blasts readily although the rock is very hard



The quarry face is about 100 ft. high at the point where the shot was fired

ploded at one firing. The pile of broken rock was roughly surveyed and estimated to contain at least 65,000 tons, which means that a recovery of 6½ tons of rock per pound of powder used was made. Some secondary shooting has been necessary but not very much, so that the recovery may be estimated conservatively at six tons per pound. This compares very favorably with other quarry methods in the amount of powder used.

Every shot is plotted and the plotting is transferred to a large scale map of the quarry. Every shot is also photographed. Two or three pictures are taken as the blast is fired and as the rock is sliding down. These pictures are filed as a part of the records of the operation and if anything unusual occurred, or if the shot was not as successful as it was expected to be, the reason can generally be noted in the mapping or in the photographs. Records of shots with photographs have been filed for several years now and constitute a book of reference that is invaluable in planning future work.

The broken rock is loaded by two 60-ton Marion shovels into 4-yd. Western cars. A 14-ton Davenport locomotive brings them in to the plant where they are hoisted up an incline and discharged directly into the primary jaw crusher. This is a 40x42 jaw crusher of Buchanan make. All the crusher product goes by a conveyor belt, 102 ft. long and 30 in. wide, to a No. 8 Allis-Chalmers crusher, from which it is elevated to the scalping screens. The elevator is of the bucket and belt type, 38-ft. centers with 30-in. buckets. The scalping screen is 48 in. by 20 ft. and it has a section with 2¾-in. holes and a jacket with ⅝-in. holes. The intermediate product goes to the ballast bins by a conveyor belt, the jacket undersize goes to the screenings bin and the oversize, which is 80% of the original feed, goes to the secondary crushers.

There are four of these, two No. 5 Gates and two No. 5 McCally's. Their product is lifted 96 ft. by a 30-in. elevator to the two sizing screens, which are 48 in. by 20 ft. The troughs of these screens go to bins and the oversize goes to the secondary crushers and also to two Buchanan 14x30-in. rolls, which are set to make ¾-in. material. The product of these rolls joins the product of the secondary crushers so that all recrushing is in closed circuit with the sizing screens and the 96-ft. elevator.

The plant was originally steam driven, but it was changed over to electric drive in March, 1926. This company operates another quarry in Stringtown, Okla, which is near McAllister. The operation at Stringtown has just been developing a new quarry face, the original face having been worked back as far as it was found profitable.

The office of the Texas Trap Rock Corp. is in the Maverick building, San Antonio, Texas. W. F. Wise is president and T. F. Sharp is general manager and purchasing agent and E. O. Jones, quarry superintendent.

British Quarry Managers Hold Annual Conference

THE Seventh Annual Conference of the Institution of Quarry Managers was held at Harrogate from June 27 to July 2. It was opened officially by Sir Henry Maybury, K.C.M.G., C.B., president of the Institution of Quarry Managers. The annual general meeting, on June 28, must have registered a record attendance, and on the following morning large numbers of the delegates made up a party to view the eclipse. Later the following brief papers were read: E. J. Wallace, "Accident Prevention"; A. B. Searle, "Mixed Feed v. Gas-fired Lime Kilns"; J. S. Killick, M. Inst. C.E., impromptu; W. J. Rees, B.Sc., F.G.S., "The Character of Quartzite for Use in Silica Brickmaking, etc."; W. E. Farrell of the Easton Car and Construction Co., U.S.A., "Rolling Stock in Quarries"; Oswald Bond, "Standardization"; A. J. Myles, "The Future of Tarmacadam"; Dr. F. J. North, "The Use of Geological Maps by Quarrymen"; Capt. Pate, "Improvements in Sawing and Planing Machinery."

Among the business events were a visit to the works of Messrs. Rowntrees, Ltd., York, and later a visit to the various works of the Harrogate Corporation. In addition a number of successful and popular social functions were arranged.

The second annual exhibition of quarrying plant and materials and plant equipment was held in Birkdale's Playing Fields, Harrogate, from June 28 to July 2 inclusive, and this also was opened by Sir Henry P. Maybury.—*London Contract Journal.*

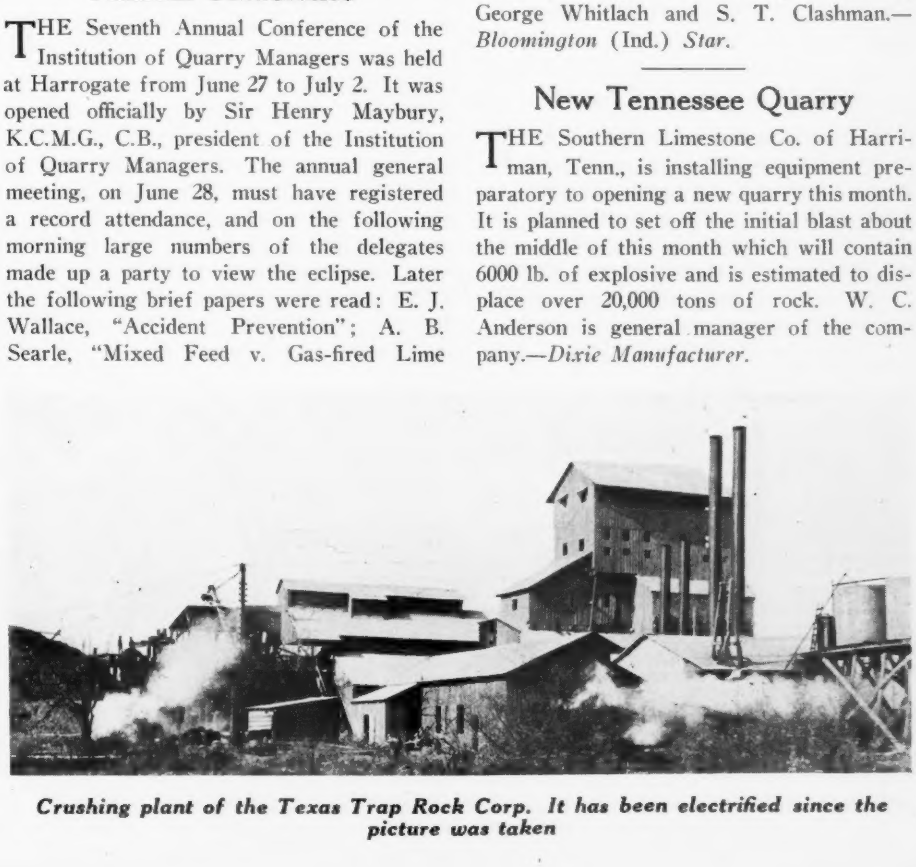
Indiana Looking for New Quarries

IN an attempt to locate new quarries, members of the Indiana Geological Survey, headed by Dr. W. N. Logan, state geologist, and composed of several geologists are observing sections in Monroe, Putnam and Lawrence counties this summer.

The survey expects to locate stone quarries, stone plants and railroads on maps to be used by the geology department of the state, according to Dr. Logan. Those conducting the investigation, other than Dr. Logan, are Ralph Esarey, R. E. Stouder, Louis Childs, Jesse Casserman, H. Rankin, George Whitlach and S. T. Clashman.—*Bloomington* (Ind.) *Star.*

New Tennessee Quarry

THE Southern Limestone Co. of Harriman, Tenn., is installing equipment preparatory to opening a new quarry this month. It is planned to set off the initial blast about the middle of this month which will contain 6000 lb. of explosive and is estimated to displace over 20,000 tons of rock. W. C. Anderson is general manager of the company.—*Dixie Manufacturer.*



Crushing plant of the Texas Trap Rock Corp. It has been electrified since the picture was taken

Financial News and Comment

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

(These are the most recent quotations available at this printing. Revisions, corrections and supplemental information will be welcomed by the editor.)

Stock	Date	Par	Price bid	Price asked	Dividend rate
Allentown Portland Cement Co. (common)[32]	May 24	...	1½	3	
Allentown Portland Cement Co. (6% bonds, 1932)[32]	May 24	...	87	92	
Alpha Portland Cement Co. (common)[2] new stock	July 16	No par	38	40	75c quar. July 15
Alpha Portland Cement Co. (preferred)[2]	July 16	100	115	...	1¾% quar. June 15
American Lime and Stone Co. (7% bonds, 1942)[32]	May 24	...	97	101	
Arundel Corporation (sand and gravel—new stock)	July 18	No par	35¼	35¾	50c July 1
Atlantic Gypsum Products Corp. (1st 6's carrying 10 sh. com.)[10]	July 19	...	119	121	
Atlas Portland Cement Co. (common)[2]	July 16	No par	42	44	50c qu. June 1
Atlas Portland Cement Co. (preferred)	...	100	...	...	2% quar. Oct. 1
Atlas Portland Cement Co. (preferred)[2]	July 16	33⅓	43	...	2% quar. July 1
Beaver Portland Cement Co. (1st Mort. 7's)[8]	July 29	100	100	100	
Bessemer Limestone and Cement Co. (Class A)[4]	Apr. 8	...	34	34¾	75c quar. May 1
Bessemer Limestone and Cement Co. (6½% bonds)[4]	Apr. 8	...	99	100	
Boston Sand and Gravel Co. (common)	July 15	100	72	...	1% qu., 2% ex. Jan. 1
Boston Sand and Gravel Co. (preferred)	July 15	...	...	85	1¾% quar. Jan. 1
Boston Sand and Gravel Co. (1st preferred)	July 15	...	...	90	2% quar. Jan. 1
Canada Cement Co., Ltd. (common)	July 18	100	146	147	1½% qu. July 16
Canada Cement Co., Ltd. (preferred)[11]	July 16	100	118	119	1¾% quar. May 16
Canada Cement Co., Ltd. (1st 6's, 1929)[11]	July 4	...	101	102½	3% semi-annual A&O
Canada Crushed Stone Corp., Ltd. (6½s, 1944)[11]	July 4	100	95	99	
Charles Warner Co. (lime, crushed stone, sand and gravel)	July 14	No par	26½	...	50c July 11
Charles Warner Co. (preferred)	July 14	100	104	...	1¾% quar. July 28
Charles Warner Co. (lime, crushed stone, sand and gravel) 7s, 1929[16]	July 1		Retired at 102		
Cleveland Stone Co. (new stock)	July 18	...	60	65	50c qu. June 15
Connecticut Quarries Co. (1st Mortgage 7% bonds)[17]	July 15	100	105	...	
Consolidated Cement Corp. (1st Mort., 6½s, series A)[24]	July 19	100	96	99	
Consolidated Cement Corp. (5 yr. 6½% gold notes)[24]	July 19	100	94	98	
Consumers Rock and Gravel Co. (1st Mort. 7s)[18]	July 14	100	99	101½	
Coosa Portland Cement Co. (6% bonds, 1944)[32]	May 24	...	70	...	
Coplay Portland Cement Co. (6% bonds, 1941)[32]	May 24	...	88	...	
Dewey Portland Cement Co. (1st mort. 6's 1942)[30]	July 19	100	99	100	
Dolese and Shepard Co. (crushed stone)[7]	July 18	50	96	98	$1.50 July 1, $1 ex. July 1
Egyptian Portland Cement Co. 7% pfd.[21]	July 1	...	80	90	1¾% quar. July 1
Egyptian Portland Cement Co. (common)[21]	July 1	...	5	7	40c quar. Oct. 1
Fredonia Portland Cement Co. (6½% bonds, 1940)[32]	May 24	...	97	101	
Giant Portland Cement Co. (common)[2]	July 16	50	50	60	
Giant Portland Cement Co. (preferred)[26]	July 16	50	40	50	3½% June 15
Ideal Cement Co. (common)	July 6	No par	83	84	$1 quar., July 1
Ideal Cement Co. (preferred)[33]	July 16	100	109	111	1¾% quar. July 1
International Cement Corporation (common)	July 18	No par	55⅛	55½	$1 quar. June 30
International Cement Corporation (preferred)[2]	July 16	100	109	109¾	1¾% quar. June 30
Kelley Island Lime and Transport Co.	July 18	100	140	143	$2 quar. July 1
Lawrence Portland Cement Co.[2]	July 16	100	100	104	2% quar.
Lehigh Portland Cement Co.[6]	July 16	50	124	128	1½% quar.
Lyman Richey Sand and Gravel Co. (1st Mort. 6s, 1928 to 1931)[13]	July 15	100	99	100	
Lyman Richey Sand and Gravel Co. (1st Mort. 6s, 1932 to 1935)[13]	July 15	100	98	99	
Marblehead Lime Co. (1st Mort. 7's)[14]	July 1	100	100	...	
Marblehead Lime Co. (5½% notes)[14]	July 1	100	98	...	
Michigan Limestone and Chemical Co. (common)[6]	July 17	...	26	28	
Michigan Limestone and Chemical Co. (preferred)[6]	July 17	...	24½	26	1¾% quar. July 15
Missouri Portland Cement Co.	July 17	25	40½	41	50c May 1
Monolith Portland Cement Co. (common)[9]	July 14	...	12¼	12¾	8% ann. Jan. 2
Monolith Portland Cement Co. (units)[9]	July 14	...	30¾	32¼	
Monolith Portland Cement Co. (preferred)[9]	July 14	...	9¼	9¾	
National Gypsum Co. (common)[35]	July 19	...	58	61	
National Gypsum Co. (preferred)[35]	July 19	...	85	88	
Nazareth Cement Co.[20]	July 15	No par	30	32	75c quar. Apr. 1
Newaygo Portland Cement Co.[1]	July 15	...	120	...	
Newaygo Portland Cement Co. (6½% bonds, 1938)[32]	May 24	...	100	102	
New England Lime Co. (Series A, preferred)[14]	July 1	100	...	95	
New England Lime Co. (Series B, preferred)[22]	July 16	100	95	97	
New England Lime Co. (V.T.C.)[22]	July 16	...	33	36	
New England Lime Co. (6s, 1935)[14]	July 1	100	99	101	
New York Trap Rock Corp. (6% bonds, 1946)[32]	July 18	...	99⅝	99¾	
North American Cement Corp. 6½s 1940 (with warrants)	July 18	100	90	90	
North American Cement Corp. (units of 1 sh. pfd. plus ½ sh. common)[32]	July 14	...	60	65	2 mo. period at rate of 7%
North American Cement Corp. (common)[19]	Apr. 9	...	8⅛	9	
North American Cement Corp. (preferred)	Apr. 25	...	...	...	1.75 quar. Aug. 1
North Shore Material Co. (1st Mort. 6's)[15]	July 19	100	98½	100	
Pacific Portland Cement Co., Consolidated[5]	July 16	100	61¾	75	25c mo.
Pacific Portland Cement Co., Consolidated (secured serial gold notes)[5]	July 16	100	97¼	...	3% semi-annual Oct. 15
Peerless Portland Cement Co.[1]	July 15	10	4⅜	4⅞	
Pennsylvania-Dixie Cement Corp. (1st Mort. 6's)[29]	July 18	100	99¼	99¼	
Pennsylvania-Dixie Cement Corp. (preferred)[28]	July 19	100	95	...	1¾% June 15
Pennsylvania-Dixie Cement Corp. (common)[28]	July 18	...	28½	29	80c July 1
Petoskey Portland Cement Co.[1]	July 18	10	10½	11¼	1½% quar.
Pittsfield Lime and Stone Co.[31]	Apr. 26	...	...	100	
Pittsfield Lime and Stone Co.[31] (common)	Feb. 25	...	...	25	

(CONTINUED ON PAGE 78)

[1]Quotations by Watling, Lerchen & Hayes Co., Detroit, Mich. [2]Quotations by Bristol & Willett, New York. [3]Quotations by True, Webber & Co., Chicago. [4]Quotations by Butler, Beading & Co., Youngstown, Ohio. [5]Quotations by Freeman, Smith & Camp Co., San Francisco, Calif. [6]Quotations by Frederic H. Hatch & Co., New York. [7]Quotations by F. M. Zeiler & Co., Chicago, Ill. [8]Quotations by Ralph Schneeloch Co., Portland, Ore. [9]Quotations by A. E. White Co., San Francisco, Calif. [10]Quotations by Lee Higginson & Co., Boston and Chicago. [11]Nesbitt, Thomson & Co., Montreal, Canada. [12]E. B. Merritt & Co., Inc., Bridgeport, Conn. [13]Peters Trust Co., Omaha, Neb. [14]Second Ward Securities Co., Milwaukee, Wis. [15]Central Trust Co. of Illinois, Chicago. [16]J. S. Wilson, Jr., Co., Baltimore, Md. [17]Chas. W. Scranton & Co., New Haven, Conn. [18]Dean, Witter & Co., Los Angeles, Calif. [19]Hemphill, Noyes & Co., New York. [20]Quotations by Bond & Goodwin & Tucker, Inc., San Francisco. [21]Baker, Simonds & Co., Inc., New York. [22]William C. Simons, Inc., Springfield, Mass. [23]Blair & Co., New York and Chicago. [24]A. B. Leach and Co., Inc., Chicago. [25]A. C. Richards & Co., Philadelphia, Penn. [26]Hincks Bros. & Co., Bridgeport, Conn. [27]J. G. White and Co., New York. [28]Mitchell-Hutchins Co., Chicago, Ill. [29]National City Co., Chicago, Ill. [30]Chicago Trust Co., Chicago. [31]McIntyre & Co., New York, N. Y. [32]Hepburn & Co., New York. [33]Boettcher & Co., Denver, Colo. [34]Kidder, Peabody & Co., Boston, Mass. [35]Farnum, Winter and Co., Chicago. [36]Hanson and Hanson, New York.

Editorial Comment

Building Conditions

Despite floods, storms and slumps in such important industries as steel (which was reported last week to be at only 55% of capacity) construction is going forward steadily. Building permits and contracts for 1927 are running ahead of the first six months of 1926. According to the figures of *Engineering News Record* the advance is about 11%. The promise is that there will be no let up in the latter half of 1927. J. M. Mercer, editor of the *Journal of the Western Society of Engineers,* says in a communication to Harper Leach of the *Chicago Tribune:*

"The better grade of engineers are busy. Seldom has there been a steadier demand for the more mature and experienced—the men who do the original planning of big jobs which materialize later.

"I am under the impression that a large number of medium sized projects are being initiated, rather than a few big ones. It is certain that employment for engineers, whose brains are employed in the processes of design, is better than that of those who are employed on actual construction.

"When designs, now being created, fruit into actual work we expect a better demand for the junior grades. In fact, there has been a distinct firming of demand for these younger men in the last 30 days—indicating the passage of many projects from the planning to the construction stage."

Abundant credit is given as the reason for the planning and initiation of so many construction projects. The price of building materials reflects the situation, as the average for the first six months of 1927 is slightly higher than for the same period of 1926, taking the figures of the Associated General Contractors Association as authoritative. These figures include all building materials. In the rock products markets conditions are not so cheerful. An averaging of cement prices at 13 large distributing centers showed a steady fall from January on through May, although since May the average price has improved somewhat. The average price of aggregates has apparently declined a little from the beginning of the year.

Design of Concrete Mixes

A. T. Goldbeck has done the engineering world a service in pointing out the limitations of the water-cement ratio theory of designing concrete and suggesting a specification to overcome those limitations. A digest of his paper is printed in this issue. The water-cement ratio was becoming a sort of "holy cow" at whose shrine all engineers must worship. Prof. Abrams of course has not been responsible for this, but some of his too enthusiastic supporters have been. The water-cement ratio theory is true, but it is not all the truth.

Designing a concrete mix is an engineer's job and no amount of "simplification" is ever going to put it to where an ignorant laborer can mix any sort of materials into concrete and get uniformly good results. It is true that one can take a table of quantities and combine materials to make a satisfactory concrete, but this is only possible when the aggregates are what they should be, the measurements properly made and when the weather is right for curing. It is a real engineering problem to take untried materials and test them and combine them in such a way as to get the most strength in concrete for the least money. And to solve such a problem requires that attention be given to several other things beside the quantity of water that goes in with the cement.

The small user can have all this done for him if he buys his concrete from a central mixing plant.

Squelching a Municipal Plant

The Pacific Coast Rock Products Association, and its secretary, E. Earl Glass, have done the entire industry a service in preventing the establishment of a municipal rock, sand and gravel plant by the city of Los Angeles. Mr. Glass' analysis of the reports which favored a municipal plant is given elsewhere in abstract form. It showed that the city expected to make crushed rock for 90 cents a ton at a point where it was already buying it for 86 cents and that to do this it intended to put up a plant costing $610,000 when, as Mr. Glass assured the council, equally good and established in business plants could be bought for $300,000. There were other arguments, but these of themselves should be sufficiently convincing. If the city council should still decide to put up a plant it will find it hard to convince the voters and taxpayers of the city that it did not have something more than the public interest in mind. Other organizations, especially those interested in civic affairs, have expressed themselves emphatically as opposed to the proposed municipal plant.

Who are the proponents of these state, county and municipal plants and why are they so anxious to see them established? Rock Products has always taken the charitable view of them and assumed them to be honest but misguided persons, unfortunate enough to be bitten by the socialistic bug and not able to recover from the effects of the bite. But there are times when one wonders. For all such municipally owned enterprises there are lands to be bought and machinery to be purchased, and profits to be made on both land and machinery. Wherever producers are threatened with competition from state, county and city owned plants, it would be well for them to find out who is behind the move and who benefits from it. Too often such things are kept quiet and then announced after a vote has been taken in a poorly attended session.

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS (Continued)

Stock	Date	Par	Price bid	Price asked	Dividend Rate
Riverside Portland Cement Co.	May 9	....	165	....	
Rockland and Rockport Lime Corp. (1st preferred)[34]	July 19	100	100	....	3½% semi-annual Feb. 1
Rockland and Rockport Lime Corp. (2nd preferred)[34]	July 19	100	60	....	3% semi-annual Feb. 1
Rockland and Rockport Lime Corp. (common)[34]	July 19	No par	55	....	1½% quar. Nov. 2
Sandusky Cement Co. (common)[1]	July 18	100	125	135	$2 qu. July 1
Santa Cruz Portland Cement Co. (bonds)[5]	July 15	....	106	....	6% annual
Santa Cruz Portland Cement Co. (common)[5]	July 15	....	85	90	$1 quar., $1 ex. Jan. 1
Schumacher Wallboard Corp. (common)	July 16	....	26	26⅜	
Schumacher Wallboard Corp. (preferred)	July 16	....	26	....	
Southwestern Portland Cement Co. (units)	May 11	....	205	....	
Superior Portland Cement, Inc. (Class A)[30]	July 15	....	45	45¼	
Superior Portland Cement, Inc. (Class B)[30]	July 15	....	23	23½	
United Fuel and Supply Co. (sand and gravel) 1st Mort. 6s[27]	July 14	100	98	100	
United Fuel and Supply Co. (sand and gravel) 6% gold notes[27]	July 14	100	98	100	
United States Gypsum Co. (common)	July 18	20	93¼	94	40c quar. June 30
United States Gypsum Co. (preferred)	July 18	100	122	122	1¾% quar. June 30
Universal Gypsum Co. (common)[3]	July 18	No par	....	6	
Universal Gypsum V.T.C.[3]	July 19	No par	4	5½	
Universal Gypsum Co. (preferred)[3]	Nov. 23	....	73	77	1½% Feb. 15
Universal Gypsum and Lime Co. (1st 6's, 1946)[3]	July 19	100	....	96	
Union Rock Co. (7% serial gold bonds)[18]	July 14	....	99	101	
Upper Hudson Stone Co. (1st 6's, 1951)[32]	May 24	....	93	....	
Upper Hudson Stone Co. (1st 6's, 1937)[32]	May 24	....	104	....	
Vulcanite Portland Cement Co. (7½% bonds, 1943)[32]	May 24	100	98½	101	
Whitehall Cement Mfg. Co. (common)[36]	July 14	....	98	....	
Wisconsin Lime and Cement Co. (1st Mort. 6s, 1940)[15]	July 19	100	99	....	
Wolverine Portland Cement Co.	July 18	10	7	7½	15c quar. Aug. 15
Yosemite Portland Cement Co.	May 11	....	7½	....	

QUOTATIONS OF INACTIVE ROCK PRODUCTS SECURITIES

Stock	Date	Par	Price bid	Price asked	Dividend rate
Asbestos Corp. of Amer. (5 sh. pfd. and 5 sh. com.)[1]	June 22	....	$1 for the lot		
Atlanta Shope Brick and Tile Co.[1]	Nov. 24	....	25c	....	
Benedict Stone Corp. (cast-stone) (50 sh. pfd. and 390 sh. com.)[1]	Dec. 29	....	$400 for the lot	....	
Blue Stone Quarry (60 shares)[2]	Mar. 16	....	$10¼ for the lot	....	
Coplay Cement Mfg. Co. (common) (4)	Dec. 16	....	[illegible]	....	
Coplay Cement Mfg. Co. (preferred) (1)	Dec. 30	....	70	....	
Eastern Brick Corp. (7% cu. pfd.) (1)	Dec. 9	10	40c	....	
Eastern Brick Corp. (sand lime brick) (common) (1)	Dec. 9	10	40c	....	
Edison Portland Cement Co. (common)[4]	Sept. 11	50	20c	....	
Edison Portland Cement Co. (preferred)	Nov. 3	50	17½c(x)	....	
International Portland Cement Co., Ltd. (preferred)	Mar. 1	....	30	45	
Globe Phosphate Co. ($10,000 1st mtg. bonds, $169.80 per $1000 paid on prin.)	Dec. 22	....	$50 for the lot	....	
Iroquois Sand and Gravel Co., Ltd. (2 sh. com. and 3 sh. pfd.) (1)	Mar. 17	....	$12 for the lot	....	
Knickerbocker Lime Co.x	June 22	....	100	....	
Limestone Products Corp. (150 sh. pfd., $50 par, and 150 sh. com., no par)	Dec. 22	....	$60 for the lot	....	
Missouri Portland Cement Co. (serial bonds)	Dec. 31	....	104¾	104¾	3¼% semi-annual
Olympic Portland Cement Co. (g)	Oct. 13	....	....	£1⅝	
Phosphate Mining Co. (1)	Nov. 24	....	1	....	
River Feldspar and Milling Co. (50 sh. com. and 50 sh. pfd.) (1)	June 23	....	$200 for the lot		
Rockport Granite Co. (1st 6's, 1934)[2]	Aug. 31	....	90	....	
Simbroco Stone Co.[2]	Apr. 20	....	12	12	
Southern Phosphate Corp.[6]	Sept. 15	....	1¼	....	
Tidewater Portland Cement Co. (3000 sh. com.)	Dec. 22	....	$6525 for the lot	....	
Vermont Milling Products Co. (slate granules) 22 sh. com. and 12 sh. pfd. (6)	Nov. 3	....	$1 for the lot	....	
Wabash Portland Cement Co.[1]	Aug. 3	50	60	100	
Winchester Brick Co. (preferred) (sand lime brick) (5)	Dec. 16	....	10c	....	

(g) Neidecker and Co., Ltd., London, England. (1) Price obtained at auction by Adrian H. Muller & Sons, New York. (2) Price obtained at auction by R. L. Day and Co., Boston. (3) Price obtained at auction by Weilepp-Bruton and Co., Baltimore, Md. (4) Price obtained at auction by Barnes and Lofland, Philadelphia, Pa. (5) Price obtained at auction for lot of 50 shares by R. L. Day and Co., Boston, Mass. (x) Price obtained at auction by Barnes and Lofland, Philadelphia, on November 3, 1925. (6) Price obtained at auction by Wise, Hobbs and Arnold, Boston, Mass.

International Cement Second Quarter Report

INTERNATIONAL CEMENT CORP., for quarter ended June 30, 1927, reports net income of $1,142,253 after charges, depreciation and federal taxes, equivalent, after allowing for 7% preferred dividend requirements, to $1.74 a share earned on 562,500 shares of no-par common stock. This compares with $906,292, or $1.30 a share, in preceding quarter, and $1,058,786, or $1.77 a share on 500,000 common shares outstanding in the second quarter of 1926.

Net income for the first six months of 1927 was $2,048,546, after above charges, equal to $3.04 a share on 562,500 common shares, against $1,804,957, or $2.92 a share on 500,000 shares in first half of previous year.

Income account for period ended June 30, 1927, compares as follows:

BROWN BROS. & CO., Edward B. Smith & Co., Cassatt & Co., Philadelphia, Penn., are offering at 99½ and accrued interest, to yield over 6%, $5,000,000 first mortgage 6% sinking fund gold bonds of the Pennsylvania Glass Sand Corp. Dated July, 1927; due July 1, 1952. Cumulative sinking fund to retire by lot all bonds at or before maturity at 105 and interest.

The following data are from a letter of A. J. Fink, who is to be chairman of the board of directors of the Pennsylvania Glass Sand Corp.:

History.—Pennsylvania Glass Sand Corp., to be presently organized under the laws of Pennsylvania, is to acquire the entire properties and assets of Pennsylvania Glass Sand Co., together with the physical properties of Berkeley Glass Sand Co. (W. Va.), E. F. Millard Sand Works (W. Va.), West Virginia and Pittsburgh Sand Co. (W. Va.), Pittsburgh White Sand Co. (Penn.) and the Maryland Glass Sand Co., Inc. (Md.), together with certain reserve silica deposits near Hancock, Md., known as the H. S. Randolph property and Bridges Estate property. It will thus become a very important factor in the production of silica, feldspar and products derived therefrom.

Pennsylvania Glass Sand Co., the largest company of the group, has in each year from the date of its organization (in 1902) operated at a profit and shown steady and continuous growth. The same is true of the other companies, with minor exceptions.

Business.—The production of silica is a basic industry. Pure silica is the basic material in the manufacture of all kinds of glassware and a wide variety of other products, including pottery, sanitary ware, vitrolite (a substitute for marble), electric porcelain and insulators, chinaware, floor and wall tile, composition flooring, scouring and buffing compounds, metal polish and paint filler. The properties to be acquired by the corporation are located in the Oriskany Vein, which furnishes a pure silica. This vein is practically the only deposit of pure silica

INTERNATIONAL CEMENT CORP. COMPARATIVE INCOME ACCOUNT, 1924-1927

For quarter ended June 30	1927	1926	1925	1924
Gross sales	$7,868,402	$6,856,967	$5,452,301	$4,487,314
Expenses, etc.	5,951,419	5,038,723	3,855,413	3,296,554
Depreciation	470,943	465,286	270,406	265,058
Net	$1,446,040	$1,352,958	$1,326,482	$ 925,702
Other income	....	....	5,149	21,079
Total income	$1,446,040	$1,352,958	$1,331,631	$ 946,781
Interest, taxes, etc.	303,787	294,172	221,028	268,490
Net income	$1,142,253	$1,058,786	$1,110,603	$ 678,291

Six months ended June 30	1927	1926	1925	1924
Gross sales	$13,842,127	$11,705,169	$9,234,502	$7,448,912
Expenses, etc.	10,500,361	8,707,016	6,588,776	5,532,728
Depreciation	794,404	717,701	441,761	447,559
Net	$2,547,362	$2,280,452	$2,203,965	$1,468,625
Other income	....	....	13,163	24,035
Total income	$2,547,362	$2,280,452	$2,217,128	$1,492,661
Interest, taxes, etc.	498,816	475,495	392,587	372,357
Net income	$2,048,546	$1,804,957	$1,824,541	$1,120,303

in the eastern part of the United States. Such properties include 20 plants for preparation of silica, 23 developed quarries, as well as over 6750 acres of silica deposits, of which approximately 4100 acres are owned in fee and the remainder under long-term leases. The corporation will also control mineral rights and leases on large feldspar deposits in Canada and a plant for its preparation.

All properties are well located with reference to transportation facilities, water supply and market, and in the opinion of Ford, Bacon & Davis, Inc., the developed silica deposits and reserves are sufficient for an operating life of the properties greatly in excess of 50 years. The plants with two minor exceptions are operated by electricity, and the crushing and pulverizing machinery is of the most modern type. Practically no skilled labor is required to operate either quarries or plants.

Valuation.—The properties to be acquired by the corporation, including plants, plant sites, buildings, machinery, silica deposits, other mineral lands and business as consolidated, have recently been appraised by Ford, Bacon & Davis, Inc., as having a commercial value of $14,100,000. The nature of the corporation's business is such that it requires the carrying of little or no inventory other than supplies and stores.

Security.—These bonds will be direct obligations of the corporation and will be secured by a direct first mortgage upon all of the properties formerly owned by Pennsylvania Glass Sand Co. and the other properties to be acquired as stated above.

PENNSYLVANIA GLASS SAND CORP.
BALANCE SHEET

(Giving effect to the issuance of $5,000,000 first mortgage 6% sinkng fund gold bonds; 30,000 shares of $7 cumulative convertible preferred stock without par value, and 300,000 shares of common stock without par value; and the acquisition of all the assets and liabilities of the Pennsylvania Glass Sand Co. and the properties and inventories of other sand companies.)

ASSETS		
Cash in banks and on hand		$ 178,987.44
Accounts receivable		260,093.30
Inventories:		
Supplies, stores and sand finished and in process	$150,000.00	
Crude feldspar	115,160.65	
		265,160.65
		$ 704,241.39
Deferred accounts		335,859.77
Property, including silica sand reserves and other mineral reserves, land, plants, machinery and equipment and business as consolidated having a commercial value as appraised by Ford, Bacon & Davis, Inc.		14,100,000.00
		$15,140,101.16
LIABILITIES		
Accounts payable		$ 62,940.45
Accrued accounts		39,268.51
Reserve for federal income taxes of Pennsylvania Glass Sand Co., 11 months ended May 31, 1927		65,000.00
		$ 167,208.96
First mortgage 6% sinking fund gold bonds due July 1, 1952		5,000,000.00
		$5,167,208.96
CAPITAL AND SURPLUS		
Capital and capital surplus:		
30,000 shares $7-cumulative convertible pfd. stock without par value (authorized and issued); 300,000 shares com. stock without par value, issued (450,000 shares authorized)		$8,985,529.50
Surplus acct. (earned surplus of Pennsylvania Glass Sand Co. and its subsidiaries)		987,362.70
		$ 9,972,892.20
		$15,140,101.16

Purpose.—The proceeds of these bonds and of 30,000 shares of $7 cumulative convertible preferred stock, which stock has already been subscribed for, will be used to provide for the acquisition of these properties and for working capital.

Sinking Fund.—The mortgage will provide for a cumulative sinking fund payable semi-annually, calculated to be sufficient to retire the entire issue by maturity, to be applied to the redemption of bonds by lot on interest dates, at 105 and accrued interest. The combined charges for interest and sinking fund will be $400,000 per annum.

Earnings.—The combined earnings of the several companies available for interest, depreciation and federal taxes, excluding items which would not apply to the corporation, as certified by Messrs. Lybrand, Ross Brothers & Montgomery, were as follows:

Calendar Years	Earnings
1924	$ 905,512
1925	1,016,490
1926	1,079,709

The annual average of these earnings is over $1,000,000 or over two and one-half times the $400,000 combined interest and sinking fund charges on these bonds.

CAPITALIZATION

(Upon acquisition of properties as hereinafter stated)

First (closed) mortgage 6% sinking fund gold bonds due July 1, 1952 (this issue)	$5,000,000
$7 cumulative convertible preferred stock, without par value; shares	30,000
Common stock, without par value; shares	*300,000

*Exclusive of 150,000 shares reserved to provide for conversion of preferred stock.

Management.—The business of the corporation will be under the direct supervision of men of wide experience in the silica business, including, as president, W. I. Woods, and as vice-president, H. P. Bridges, who have been in the active management of the Pennsylvania Glass Sand Co. and Berkeley Glass Sand Co., respectively, for over 16 years. To provide for continuity of management, the common stock of the corporation will be placed in a voting trust.

Penn-Dixie Earnings

PENNSYLVANIA-DIXIE Cement Corp. reports net of $3,094,882 after all charges for the 12 months ended June 30, of $5.46 a share on the common, after allowing for preferred dividends. Net for the six months ended June 30, was $924,859, equal to $1.17 a share after preferred dividends.

Cement Plant Being Appraised

THE Concrete, Colo., cement plant of the Ideal Cement Co., Denver, Colo., which the Federal court ordered to be sold in its decision that the company was violating the Sherman anti-trust law, is being appraised by C. A. Schneider, engineer for the firm of Ford, Bacon & Davis of New York.

It was found necessary to call in the appraiser when differences of opinion as to the value of the plant prevented any action being taken. Mr. Schneider must break the deadlock between the court, which estimates the worth of the plant at $1,300,000, and the Ideal Cement Co.'s valuation of about three million dollars. Upon the completion of the appraisal Judge T. Blake Kennedy of Cheyenne, Wyo., will set the date of the sale.

C. J. Spencer Joins Owens Company

C. J. SPENCER, who for several years has been connected with the Carey Limestone Co., Carey, Ohio., has been appointed sales manager for John D. Owens and Son, Owens, Ohio. The Owens company is now making a finishing lime from high calcium stone produced at Rising Sun, Ohio., and carried by rail to the plant at Owens. This plant formerly produced mason's lime but additional equipment has been installed to make the finishing lime.

A special freight rate on this stone has been granted. This rate is called a "burning in transit" rate and under its conditions the rock so shipped cannot be used for anything but the manufacture of finishing lime to be reshipped to other points.

Monolith Portland Sets Off Large Blast

OVER 200,000 lb. of explosives were recently set off in a single blast at the quarries of the Monolith Portland Cement Co. at Tehachapi, Calif. The shot, which dislodged a large quantity of rock, was pronounced a success by engineers and officials of the Monolith company, who made a close examination after the blast. Several hundred people were attracted to the scene. —*Los Angeles* (Calif.) *Herald-Examiner.*

Amiesite Corporation to Build in Tennessee

THE United States Amiesite Corp. of Cleveland, Ohio, will construct an amiesite asphalt plant at Mimms, Tenn., about eight miles from Nashville. The company also plans locating plants at Memphis, Knoxville and Chattanooga. Regarding its proposed activities the *Manufacturers Record* states:

"The plant at Nashville will have a capacity of 400 tons per day and construction will be carried on by the corporation's own engineers with the co-operation of the J. D. Farasey Manufacturing Co. of Cleveland, through whom practically all equipment will be ordered. Construction details will be similar to those found in amiesite plants in Arkansas, Ohio, West Virginia and Pennsylvania.

"In addition to the plant at Nashville, it is anticipated that there will be within a short time plants at Memphis, Knoxville and Chattanooga. It is expected that employment will be given to over 100 men. The new plant at Little Rock is complete and ready to start operations immediately and we expect to produce our first tonnage within the coming week. The construction program in Tennessee calls for an expenditure of practically $250,000."

It is stated that manufacturing and sales operations in Tennessee will be in charge of Frank M. Whitfield as state manager, who will maintain offices in the Cotton States building, Nashville.

Portland Cement Output in June

June Shipments Set Record—Production and Shipments for First Six Months Above Same Period in 1926

SHIPMENTS of portland cement in June are the greatest for any month in the history of the industry, and production for the month is slightly under and second only to that of July, 1926, according to the Bureau of Mines, Department of Commerce. Portland cement stocks show a seasonal decline but are nearly 10% greater than the stocks at the end of June, 1926.

Production and shipments of portland cement for the first half of 1927 show increases respectively of over 4 and 5% over the corresponding period in 1926.

The output of another new plant, located in Louisiana, which began operating in June, is included in these statistics which are prepared by the Division of Mineral Statistics of the Bureau of Mines and are compiled from reports for June, 1927, received direct from all manufacturing plants except two, for which estimates are necessary on account of lack of returns.

Clinker Stocks

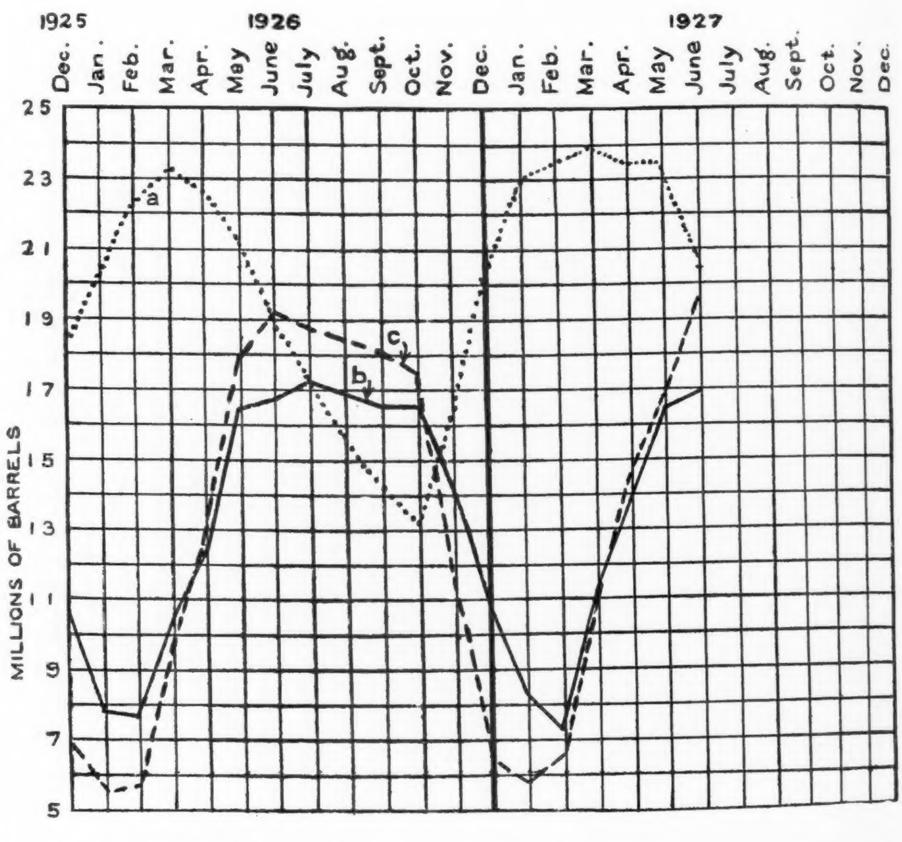
Stocks of clinker, or unground cement, at the mills at the end of June, 1927, amounted to about 10,840,000 bbl. compared with 12,488,000 bbl. (revised) at the beginning of the month.

ESTIMATED CLINKER (UNGROUND CEMENT) AT THE MILLS AT END OF EACH MONTH, 1926 AND 1927

Month	1926	1927
January	9,074,000	9,989,000
February	10,931,000	11,943,000
March	12,290,000	12,997,000
April	12,967,000	13,335,000
May	11,695,000	*12,488,000
June	10,144,000	10,840,000
July	8,604,000	
August	7,362,000	
September	6,112,000	
October	5,370,000	
November	5,748,000	
December	7,799,000	

*Revised.

MONTHLY FLUCTUATION IN PRODUCTION, SHIPMENTS AND STOCKS OF FINISHED PORTLAND CEMENT



(a) Stocks of finished portland cement at factories. (b) Production of finished portland cement. (c) Shipments of finished portland cement from factories

Distribution of Cement

The following figures show shipments from portland cement mills distributed among the states to which cement was shipped during April and May, 1926 and 1927:

PORTLAND CEMENT SHIPPED FROM MILLS INTO STATES IN APRIL AND MAY, 1926 AND 1927, IN BARRELS*

Shipped to—	1926—April	1927	1926—May	1927
Alabama	215,372	173,893	184,774	164,359
Alaska	957	1,037	2,296	2,514
Arizona	40,257	47,573	37,717	46,724
Arkansas	62,646	53,331	64,713	77,207
California	850,124	1,137,845	1,165,540	1,281,461
Colorado	104,386	86,431	119,761	109,671
Connecticut	149,459	179,863	209,515	193,315
Delaware	48,259	40,699	38,972	35,564
District of Columbia	82,579	89,048	85,961	79,566
Florida	323,909	271,575	386,712	234,914
Georgia	171,829	168,681	186,398	209,126
Hawaii	27,999	25,876	13,705	25,631
Idaho	47,688	32,063	58,044	26,767
Illinois	961,612	956,012	1,671,317	1,402,964
Indiana	310,301	†418,874	†570,942	561,019
Iowa	219,716	†211,248	317,323	357,184
Kansas	204,165	203,368	259,208	294,596
Kentucky	141,326	†148,567	†188,486	188,319
Louisiana	99,889	107,023	96,519	116,352
Maine	33,345	39,031	51,441	49,870
Maryland	199,076	224,405	279,126	224,398
Massachusetts	298,326	293,606	362,878	289,218
Michigan	576,865	†857,574	†1,182,060	1,258,924
Minnesota	296,040	258,506	496,800	387,814
Mississippi	65,511	78,127	73,146	74,061
Missouri	505,850	312,311	696,773	409,889
Montana	23,063	23,882	23,832	24,561
Nebraska	170,591	96,255	190,275	155,964
Nevada	8,478	10,406	8,165	7,495
New Hampshire	37,909	43,932	46,559	38,333
New Jersey	653,779	897,645	770,730	894,457
New Mexico	15,861	28,566	12,004	31,149
New York	1,633,864	2,131,528	2,223,644	2,188,026
North Carolina	357,978	324,758	424,474	367,215
North Dakota	39,039	38,157	58,351	40,034
Ohio	674,151	†837,050	†1,200,619	948,788
Oklahoma	220,016	242,747	229,209	327,529
Oregon	126,874	122,281	127,318	152,050
Pennsylvania	1,243,762	†1,199,544	†1,614,063	1,331,265
Porto Rico	0	1,000	0	2,250
Rhode Island	64,303	78,743	96,407	77,876
South Carolina	49,573	82,680	58,544	87,442
South Dakota	43,693	35,465	61,899	38,442
Tennessee	178,683	180,574	201,130	217,416
Texas	411,203	472,879	431,778	545,848
Utah	35,218	31,793	†38,301	32,759
Vermont	14,358	30,185	28,202	29,715
Virginia	161,284	135,226	196,368	168,463
Washington	189,037	248,518	212,259	223,574
West Virginia	154,310	†112,009	†217,546	141,521
Wisconsin	277,248	356,961	537,441	568,828
Wyoming	13,887	14,783	17,558	17,531
Unspecified	57,493	102,398	†70,063	40,626
	12,893,141	14,296,532	†17,896,866	16,800,584
Foreign countries	71,859	53,468	76,134	58,416
Total shipped from cement plants	12,965,000	14,350,000	17,973,000	†16,859,000

*Includes estimated distribution of shipments from three plants in April and May, 1927; from four plants in April, 1926; and from five plants in May, 1926.
†Revised.

PRODUCTION, SHIPMENTS, AND STOCKS OF FINISHED PORTLAND CEMENT, BY MONTHS, IN 1926 AND 1927

Month	Production 1926	Production 1927	Shipments 1926	Shipments 1927	Stocks at end of month 1926	Stocks at end of month 1927
January	7,887,000	8,258,000	5,674,000	5,968,000	20,582,000	22,914,000
February	7,731,000	7,377,000	5,820,000	6,731,000	22,385,000	23,560,000
March	10,390,000	11,452,000	9,539,000	11,083,000	23,236,000	23,922,000
First quarter	26,008,000	27,087,000	21,033,000	23,782,000		
April	12,440,000	14,048,000	12,965,000	14,350,000	22,710,000	23,654,000
May	16,510,000	16,674,000	17,973,000	*16,859,000	21,255,000	*23,482,000
June	16,866,000	17,078,000	19,134,000	19,716,000	19,000,000	20,844,000
Second quarter	45,816,000	47,800,000	50,072,000	50,925,000		
July	17,134,000		18,812,000		17,301,000	
August	16,995,000		18,583,000		15,718,000	
September	16,571,000		18,087,000		14,188,000	
Third quarter	50,700,000		55,482,000			
October	16,596,000		17,486,000		13,334,000	
November	14,193,000		11,276,000		16,243,000	
December	10,744,000		6,432,000		20,616,000	
Fourth quarter	41,533,000		35,194,000			
	164,057,000		161,781,000			

*Revised.

PRODUCTION, SHIPMENTS, AND STOCKS OF FINISHED PORTLAND CEMENT, BY DISTRICTS, IN JUNE, 1926 AND 1927, AND STOCKS IN MAY, 1927

Commercial district	Production 1926—June	Production June—1927	Shipments 1926—June	Shipments June—1927	Stocks at end of 1926—June	Stocks at end of June—1927	Stocks at end of May 1927*
East'n Penn., N. J. & Md.	3,956,000	4,091,000	4,629,000	4,745,000	3,967,000	4,394,000	5,048,000
New York	890,000	1,009,000	1,081,000	1,262,000	1,227,000	1,420,000	1,673,000
Ohio, W. Penn. & W. Va.	*1,665,000	1,716,000	*2,051,000	2,162,000	*2,310,000	2,953,000	3,400,000
Michigan	1,430,000	1,580,000	1,614,000	1,804,000	1,734,000	1,971,000	2,195,000
Wis., Ill., Ind. & Ky.	*2,397,000	2,387,000	*2,873,000	3,086,000	*2,980,000	2,432,000	3,131,000
Va., Tenn., Ala., Ga. & La.†	1,468,000	1,414,000	1,411,000	1,357,000	1,125,000	1,203,000	1,146,000
Eastern Mo., Iowa, Minn. & S. Dak.	1,545,000	1,467,000	*1,946,000	1,927,000	2,417,000	2,829,000	3,289,000
W. Mo., Neb., Kan. & Okla.	1,129,000	994,000	1,105,000	976,000	1,454,000	1,743,000	1,725,000
Texas	416,000	469,000	454,000	454,000	478,000	330,000	314,000
Colo., Mont. & Utah	311,000	268,000	289,000	233,000	369,000	551,000	516,000
California	1,281,000	1,315,000	1,305,000	1,294,000	502,000	594,000	573,000
Oregon & Washington	378,000	368,000	376,000	416,000	437,000	424,000	472,000
	16,866,000	17,078,000	19,134,000	19,716,000	19,000,000	20,844,000	23,482,000

*Revised. †Began producing June, 1927.

EXPORTS AND IMPORTS OF HYDRAULIC CEMENT, BY MONTHS, IN 1926 AND 1927

Month	Exports 1926 Barrels	Exports 1926 Value	Exports 1927 Barrels	Exports 1927 Value	Imports 1926 Barrels	Imports 1926 Value	Imports 1927 Barrels	Imports 1927 Value
January	72,939	$216,431	75,346	$254,072	360,580	$576,717	193,175	$269,661
February	73,975	220,706	71,404	233,985	314,118	527,948	130,421	200,680
March	69,080	205,647	67,956	240,165	493,241	812,968	181,145	261,519
April	96,296	284,772	72,383	243,832	257,302	398,114	191,868	313,262
May	78,601	224,365	59,332	205,574	223,130	337,031	178,929	263,618
June	80,684	248,814			335,570	495,744		
July	130,822	370,220			250,862	395,981		
August	64,946	216,489			350,638	560,532		
September	70,920	239,174			194,129	308,224		
October	69,389	225,874			263,403	386,335		
November	76,598	238,103			55,233	82,949		
December	89,976	305,238			151,850	246,293		
	974,226	$2,995,833			3,250,056	$5,128,836		

IMPORTS OF HYDRAULIC CEMENT BY COUNTRIES, AND BY DISTRICTS, IN MAY, 1927

Imported from—	District into which imported	Barrels	Value
Belgium	Florida	19,800	$29,606
	Georgia	5,000	6,871
	Massachusetts	49,128	62,272
	New Orleans	4,069	5,051
	Oregon	8,960	11,779
	Philadelphia	43,503	61,614
	Porto Rico	7,500	15,236
	Sabine	5,000	10,000
	San Francisco	8,349	10,260
	Total	151,309	$212,689
Canada	Saint Lawrence	1,525	$3,268
Denmark and Faroe Islands	Porto Rico	16,170	$25,489
France	New York	2,107	$4,762
Germany	Maryland		$5
United K'gd'm	Los Angeles	1,000	$3,069
	Maryland	500	804
	Massachusetts	4,336	6,969
	New York	1,732	5,984
	Philadelphia	250	579
	Total	7,818	$17,405
	Grand total	178,929	$263,618

*Exports and Imports**

EXPORTS OF HYDRAULIC CEMENT BY COUNTRIES, IN MAY, 1927

Exported to—	Barrels	Value
Canada	2,695	$12,701
Central America	8,045	22,814
Cuba	10,216	26,408
Other West Indies and Bermuda	7,521	17,412
Mexico	9,766	36,753
South America	17,977	71,257
Other countries	3,067	18,229
	59,332	$205,574

DOMESTIC HYDRAULIC CEMENT SHIPPED TO ALASKA, HAWAII, AND PORTO RICO, IN MAY, 1927*

	Barrels	Value
Alaska	2,970	$9,061
Hawaii	32,028	68,569
Porto Rico	6,045	14,746
	41,043	$92,376

*Compiled from the records of the Bureau of Foreign and Domestic Commerce and subject to revision.

Census of British Cement Manufacture

PARTICULARS are given below of the values of the output returned for the years 1924 and 1907 for the cement trade. The particulars given for 1924 relate to works in Great Britain only, and those for 1907 to the United Kingdom as a whole. The output in Ireland for that year was not sufficient to disturb comparisons.

The quantity of cement manufactured in 1924 showed an increase of about 9% over the output in 1907, while the average value at works increased from about 24s. per ton in 1907 to 43s. per ton in 1924, or 79%. In both years manufacturers were instructed to exclude from the values to be stated for their products the value of returnable casks or cases. In 1924 exports of calcareous cement amounted to 651,000 tons, valued at £1,609,000, or approximately 49s. per ton f.o.b., and net imports to 160,000 tons, valued at £417,000 c.i.f., or an average of 52s. per ton. About 21% of the total quantity of cement made in 1924 was exported. In 1907 the cement exported, 764,000 tons, was nearly 26½% of the quantity made, and in comparing 1924 with 1907 it must be remembered that 78,000 tons of the 1924 exports was consigned to the Irish Free State, shipments to which were not classed as exports in 1907. The amount available in Great Britain in 1924 appears to have been greater than in 1907 by, roughly, 500,000 tons. The net output of the works in the industry in 1924 amounted to £4,679,000, and the net output per person employed was about £363 in 1924 and £132 in 1907. The cost of materials per ton of cement produced was 53% greater in 1924 than in 1907, and products other than cement were relatively more important in the later year. The aggregate cost of materials fell from about 48% of the total value of output in 1907 to about 39% in 1924. In this connection it may be noted that, per head of the aggregate number employed, the output of cement was 194 tons in 1907 and 244 tons in 1924. The larger out-turn of cement per head was due doubtless to more general use of rotary kilns.

In 1907 the number of persons employed in the industry was 14,819, and in 1924 the number totaled 12,874. The total capacity of the engines at the cement works and quarries in the industry was 90,256 hp. in 1924, of which nearly 20% was in reserve or idle, compared with 60,079 hp. in 1907. The capacity of electric generators at cement works in 1924 was 43,700 kw., and in 1907, 6685 kw.—*Chemistry and Industry.*

CENSUS OF BRITISH CEMENT MANUFACTURING INDUSTRY

Products	1924 Quantity Tons	1924 Selling Value	1907 Quantity Tons	1907 Selling Value
Cement for building and engineering purposes	3,143,000	£ 6,705,000	2,877,000	£3,439,000
Chalk, prepared (including whiting)	89,000	147,000		70,000
Lime:				
White lime		46,000		19,000
Hydraulic and other lime		95,000		61,000
Casks (not included in value of goods)		402,000		21,000
Quarry products sold		36,000		
All other products		220,000		125,000
Total value		£7,651,000		£3,735,000

Requirements of Metallurgical Limestone*

Part II. (Conclusion)—Production Problems—Consideration of Impurities—Production Cost of Fluxing Stone

By Oliver Bowles†

THE problems connected with the quarrying of fluxing stone are similar in many respects to those encountered in other branches of the limestone industry, such as the quarrying of cement materials, of limestone for lime manufacture, or in the preparation of crushed stone for ballast, highway construction or concrete aggregate. There are, however, certain noteworthy differences. For portland cement manufacture about one ton of clay or shale is added to each 3 tons of limestone, therefore the presence of clay with the limestone may be no detriment, but for fluxing purposes the clay content must be kept as low as possible. Also the raw materials for cement manufacture are finely pulverized, whereas fluxing stone must be in lump form.

General Features in the Quarrying of Fluxing Stone

The crushed-stone industry has one feature in common with flux production in that fines are undesirable, but here the similarity ends. For crushed stone physical properties, such as hardness, toughness and porosity are of greater importance than chemical composition, but for flux the chemical composition is of primary importance.

Metallurgical limestone quarrying is most nearly related to quarrying for lime manufacture, for in both these industries stone of approximately the same chemical purity is demanded. Lime for certain purposes must be made from high-calcium stone, just as open-hearth flux must be of the high-calcium type. For some limes as for some fluxes the admixture of considerable magnesium carbonate is not detrimental. Carrying the comparison further, it may be stated that for certain purposes, as for example the manufacture of plastic finishing lime, a pure dolomite is used, and similarly metallurgical stone for basic open-hearth furnace lining should consist of nearly pure dolomite. The latter rock, however, finds a much more extended use in the lime industry. The close relation of the fluxing industry to the lime industry is well illustrated by the fact that lime is used extensively for fluxing as a substitute for limestone. The similarity between the problems of quarrying metallurgical limestone and rock for lime manufacture is further exemplified by the fact that lump stone is desired in either case. Most of the lime now used is calcined in the shaft kiln for which purpose stone over 4 in. in diameter is desired. For fluxing purposes a somewhat lower size limit is allowed, stone down to 1-in. being acceptable, the upper limit being 8- to 12-in. stone. In both industries fines are undesirable, and a quarry problem common to each is a reduction to a minimum of the fines.

Two bulletins[1] already issued by the bureau cover the main features of quarrying for cement and lime manufacture, and another bulletin, the underground mining of limestone.[2] The reader is referred to these reports for a detailed discussion of methods and equipment. Owing to the similarity in the problems involved, the reports covering the raw materials for lime manufacture are of special interest.

Impurities in Limestone

Nature and Effect of Impurities—As pointed out previously the chief impurities in fluxing limestone are silica and alumina, with smaller percentages of sulphur and phosphorus. The presence of a small amount of iron is not generally regarded as injurious. While iron in oxide form is not detrimental, its presence in sulphide form as pyrite or marcasite is undesirable on account of the sulphur associated with it. As previously noted, the impurities in fluxing stone are of two types, the sulphur and phosphorus which are injurious to the finished product and the silica and alumina which, although they may have some influence on the quality of the finished metal, are for the most part simply diluents or inactive impurities that are objectionable because they require flux for their removal.

Permissible Percentage of Impurities in Flux—The maximum permissible limit of sulphur in flux is 0.5%, and it is desirable that it should not exceed 0.1%. The upper limit of phosphorus for Bessemer iron is placed at 0.01% and for non-Bessemer iron at 0.1%. In most commercial limestones the sulphur and phosphorus contents are so small that they may be disregarded. Sulphur is more common than phosphorus, for sulphides such as pyrite and marcasite are frequently found in limestone. Due to their yellow color and metallic luster the sulphides are usually easily detected.

The most common impurities, and those that demand most consideration, are silica and alumina. For blast-furnace use no set rules are given as to the permissible percentage of these impurities, but for average practice it is desirable to keep the total impurity under 5%. If a low silica ore is being smelted, a flux with considerably more than 5% impurity may be used if it is low priced. On the other hand, a siliceous ore may require a flux having less than 5% impurity. The producer should familiarize himself with the demands of individual furnaces within his market area. For basic open-hearth flux the silica content should not exceed 1%, and the alumina content 1.5%.

Purity of Stone Influenced by Quarry Methods—The above limiting figures may serve as a guide to the quarryman in his effort to produce a flux that will satisfy his customers. With these standards of purity before him the quarryman's task is so to conduct his operations that uniform stone of the requisite purity may be produced. To do so intelligently requires an intimate knowledge of the way in which the various impurities occur, for the manner of their association with the stone has an important bearing on quarry methods. It is important to emphasize that in many instances the quarry superintendent can be careful and intelligent conduct of operations produce a satisfactory flux from a quarry that under less competent management might produce a stone too impure for use. The chief ways in which impurities occur and the quarry methods involved are discussed in the following paragraphs. Consideration is given to silica and alumina, the chief impurities.

Occurrence of Impurities

Impurity an Integral Part of the Limestone—In some limestone deposits impurities such as silica and alumina are present as an integral part of the stone, that is, they are so uniformly distributed throughout the rock mass that there is no practical means of separating them from the calcium or magnesium carbonates. Siliceous and aluminous limestones are the result of uniform deposition of sand and clay particles with the carbonates when the deposits were formed. In dealing with such stone the quarryman is helpless, he must take the rock as he finds it, and seek the most profitable market for it in its impure form. Stone of this character may serve admirably for crushed

*Abstract of Information Circular 6041, June 1927, Department of Commerce, Bureau of Mines.
†Superintendent, Nonmetallic Minerals Experiment Station, Bureau of Mines, New Brunswick, N. J. (In co-operation with Rutgers University.)

[1]Bowles, Oliver, "Rock quarrying for cement manufacture," Bureau of Mines Bulletin 160, 1918, 160 pp.
Bowles, Oliver, and Myers, W. M., "Quarry problems in the lime industry," Bureau of Mines Bulletin 269, 1927 (in press).
[2]Thoenen, J. R., Underground mining of limestone: Bull. 262, Bureau of Mines, 1926, 100 pp.

stone, but if the content of impurity exceeds the limits previously given there is little hope of using it for metallurgical purposes.

Impurity in Seams and Lenses—When the limestone beds were formed, the impurities may have been deposited only at certain places and times, as by eddys or when swollen and turbid rivers carried down clay and sand. Under such conditions the impurities may be confined to narrow lenses or seams. If such lenses are not numerous, and are visibly different from the main rock mass, they may be separated out in quarrying. If hand-loading methods are followed, the loaders may be trained to recognize the impure fragments and reject them. If mechanical loading methods are employed, the picking belt may be used. This is simply a belt conveyor which carries the sized rock to storage. One or two skilled men stand by the belt and pick off the impure fragments as the rock passes by. One lime operator in Ohio improved the quality of his lime greatly by the use of a picking belt. It is a type of equipment widely used with metalliferous ores, but almost unknown in the non-metallics. It could be used with great advantage in many places. It has a decided advantage over hand selection while loading, for the hand loader is usually employed on a contract basis, and his incentive being tonnage rather than quality, there is a tendency toward carelessness in selection unless strict supervision is maintained. As the belt picker's sole duty is to remove impurities, a more thorough elimination can result.

Quarrying Variable Deposits

Impurity in Separate Strata—Conditions of deposition when a limestone bed was in process of formation may have been constant over a long period of time then through elevation or depression of the ancient sea floor, or for some other cause, conditions of deposition may have changed, and limestone beds of a different character may have been formed. Thus the succeeding beds in a ledge of limestone may vary considerably in composition. Some of the beds may be sufficiently pure for metallurgical use, while others may be too impure. The pure and the impure strata may be thin and may alternate in such a way that separation would be impractical, but on the other hand where there are only one or two thick beds of each type separation may be easy. The secret of success in such a quarry is to find a market for each type of stone produced. In one Pennsylvania quarry the upper 40-ft. ledge is used for furnace stone and for crushed stone, and the lower 45-ft. for lime manufacture. Quarrying in such a deposit should be conducted on two separate benches so that two types of rock will not be mixed. In such variable deposits, therefore, the different types of stone should be quarried separately as far as possible, and each type should be diverted to the market for which it is best suited. If some beds are unmarketable, and yet must be removed in the process of quarrying, the quarry must operate under the handicap of a high waste.

Stripping and Loading

Impurity in Overburden—The rock in a quarry may be well above the standard of purity demanded for furnace use, but as delivered to the customer it may contain too much impurity as the result of contamination with an overburden of clay or sand. Such a condition is no fault of the stone itself, and responsibility for it must be laid at the door of the quarry operator. Clean stripping is highly desirable at every metallurgical limestone quarry. The presence of erosion cavities involves difficulties that are considered in the section of this report immediately following. Wherever possible the overburden should be stripped before the rock is shot down. At many quarries, particularly where the covering is thin, the overburden is shot down with the rock, a method which accounts for much of the contamination in furnace stone. In wet weather soil so adheres to the rock that even with the most careful hand loading some sand and clay are sent to the furnaces with the stone. Even in dry weather the loading of fine materials with a fork often results in considerable soil being loaded with the rock. If loaders are urged to keep the rock pure they may go to the other extreme, and leave much good rock mixed with the soil. The shooting of rock and soil together, and making a separation at the quarry floor has very little to recommend.

Where machine loading is followed the separation of rock and soil is accomplished by screening. The screen is undoubtedly more efficient than the fork, but the presence of soil with the rock may result in some contamination particularly in wet weather.

Impurity in Erosion Cavities and Pockets—Where an overburden of clay or sand rests on a smooth rock surface the problem of clean stripping is simple. However, as limestone is slowly soluble in water containing carbon dioxide, usually the rock surface is irregular with many clay-filled cavities and pockets. This makes stripping difficult and complicates the process of quarrying a clean stone. The clay-filled fissures may descend many feet below the surface, and may be so narrow and deep that removal of clay from them becomes difficult or impossible. The surface cavities may be cleaned out by hand methods with pick and shovel, a slow and costly process. Under favorable conditions the soil may be washed out by hydraulic methods. It is inevitable, however, that in quarries of this character some soil must be shot down with the rock, and the problem is to decide on the best means of making a subsequent separation. As with overburden shot down with the stone, the ordinary method is to load the rock by hand, using a fork to separate the smaller fragments from the soil. Where the amount of clay is limited, this method may be the best to use.

Some quarries are equipped with washing plants, and a very clean stone is thus produced. Considering the heavy expense of removing clay from the seams and pockets, and the desirability of making a clean separation at the quarry floor, a washing plant may be the best solution of the problem. With an efficient washing plant at a quarry with a light overburden, the stripping charge may be eliminated, rock and soil shot down together, loaded with mechanical shovels, crushed, and the soil removed by washing during the screening process. Such methods are now employed successfully, but they require heavy capital investment and on this account are not adapted to small operations.

Magnesium Limits

Permissible Limits of Magnesium in Furnace Stone.—The effects of magnesia in fluxing stone have already been mentioned. For blast-furnace flux considerable latitude is allowed in the percentage of magnesium. Magnesium is probably about as efficient as calcium for slagging off silica and alumina, though there is some uncertainty and difference of opinion on this question. For removing sulphur and phosphorus calcium is most effective. High-calcium stone is usually preferred. The magnesium content of the average fluxing stone does not exceed 10%, but there are no fixed specifications. The fluxing stone producer must be guided chiefly by the preference of furnace operations within his market area.

In basic open-hearth steel practice a flux is added chiefly for the removal of phosphorus, and as calcium is more efficient than magnesium in this respect the magnesium content of the flux is restricted to 5%. In copper and lead smelting magnesium seems to have no detrimental effect, and no limits on the magnesium content are specified.

For basic open-hearth furnace lining a pure dolomite is desired. However, no rigid specifications have been provided, and stones with $MgCO_3$ content as low as 35% used.

It is evident from the above that for the larger uses the presence of a small percentage of magnesium is not detrimental, and need cause the fluxing-stone producer no concern. For two important uses, however, the magnesium content should be under fairly close control; for basic open-hearth steel flux it should not exceed 5%, and for lining and patching furnaces the magnesium content should be as high as possible. In quarrying for either of these uses the magnesium content of the stone is a problem of primary importance to the operator.

Magnesium as a Quarry Problem—Where high-calcium and high-magnesium stones occur in separate deposits of reasonably uniform composition the magnesium problem presents no serious difficulty. Where both types occur in the same quarry complications are likely to occur. The least complex condition is where the two types occur in separate and easily distinguishable beds. If dolomite were a product of primary deposition such a condition would be more general, and the problem of quarrying high-calcium and high-magnesium limestones and keeping

them separate from each other would be greatly simplified. The occurrence of magnesium may, however, be very erratic, certain parts of an otherwise uniform bed being dolomitized while other parts are high in calcium. The difference may be recognizable by chemical analysis only, on which account the process of quarrying a pure stone is greatly complicated.

No definite rules can be given for quarrying mixed deposits. If the two types occur in separate beds it may be possible to quarry them on separate benches. If there are thin beds or lenses of high-magnesian stone in a high-calcium deposit, and if the magnesian stone can be distinguished from the main mass and recognized on sight, it may be eliminated by hand picking while loading or removed from a picking belt by the method described previously. If the dolomite occurs in irregular pockets and cannot be recognized on sight, the problem of separation may be so difficult that the owner would be justified in diverting the product to some use where the presence of magnesium would be of little or no consequence.

Uniform Composition Desirable

In all modern metallurgical processes greater attention is being given to technical control, to the maintenance of uniform conditions of firing, to exact determination of the charge, and, what is of primary importance to the flux producer, to careful control of the composition of each constituent of the furnace charge. The furnace may be operated most economically when a proper balance is maintained between the various constituents. Variations in the composition of one constituent from time to time as successive furnace charges are proportioned tend to throw the whole charge out of balance. The effect is most noticeable where variations occur in the percentages of impurities, for one of the chief functions of furnace operation is the removal of impurities. Therefore, even small variations in the silica and alumina content of the flux may have a marked effect on furnace practice, and it is highly desirable to have a flux that may be depended upon as uniform.

Quarry Methods and Conditions Resulting in a Variable Product—The ideal limestone deposit for flux production is one that has an abundance of rock possessing a high degree of purity and uniformity in composition. Many deposits, however, are less fortunately circumstanced; variations may occur in the quality of the rock from point to point within the quarry. In quarrying such variable rock it is a real problem to work out the most logical method of obtaining the greatest uniformity in the product. Incomplete stripping with subsequent soil contamination during loading is a prolific source of fluctuating quality. In other quarries changes in quality may occur through loading rock exclusively from a high silica bed at one time, and from low silica beds at other times. If unavoidable variations occur in rock composition in different parts of the quarry, it is desirable to obtain an equal distribution of impurities throughout the entire rock mass as shipped, so that the furnace operator may depend upon having a rock of uniform composition for each successive charge. Methods of maintaining a desirable uniformity in the product are discussed in the following paragraphs.

Maintaining Desirable Uniformity

Avoidance of Overburden Contamination—As previously stated, most limestone deposits are covered with varying amounts of clay, sand or gravel, and it is highly important that as little as possible of this debris be mixed with the fluxing stone. The chief constitutents of such materials are silica and alumina, the same compounds which constitute the chief impurities in iron ores and for whose removal flux is added.

Clean stripping of the surface prior to blasting, and as complete removal as possible of clay and sand from seams and pockets, constitute a long step toward the maintenance of uniformity in the product.

Method of Quarrying Flat-lying or Moderately Dipping Variable Beds—Quarries are commonly located in a series of flat-lying or moderately dipping beds that vary somewhat in chemical composition. Due to its mode of origin, limestone in a single bed or zone of deposition is inclined to be fairly constant in composition over wide areas, the greatest variations occurring in passing from one bed to another. A series of beds, while varying considerably from each other in composition, may still all be within the limits of purity demanded for fluxing purposes. All the beds of the series may, therefore, be used, but care should be exercised to quarry in such a way that the stone as shipped will be uniform in composition. For example, a ledge may consist of one bed containing not more than 2% impurity and another bed containing 4 or 5% impurity. If these beds are quarried and loaded separately the rock supplied to a furnace at one time may differ considerably from that supplied at another time. If the same furnace burden is maintained for both types of stone inefficient furnace operation will result. The fluctuations in quality may occur so irregularly that changes in furnace burden to compensate for the changing impurity could be made only with great difficulty and at heavy expense for frequent analyses and constant supervision. At some quarries the variable beds are worked separately, and uniformity is maintained by carefully alternating the quarry cars from the different benches as the stone is loaded into bins or railroad cars.

If the quarry face consists of a series of variable beds it is usually best to work them in a single bench, and to shoot down the rock in such a manner that the materials from top to bottom of the quarry may be mixed as thoroughly as possible. The usual method is to throw down the rock by heavy blasts in well-drill holes sunk to the full depth of the face. A thorough mixing of the rock from the various beds may not be possible by blasting only, but further mixing may be accomplished by proper arrangement of tracks and by judicious operation of shovels. If fairly uniform mixing can be brought about by these means the composition of each carload of stone will approximate the average composition of the entire face, and all carloads will closely approach the same composition.

Hand loading permits more uniform mixing than power-shovel loading, for even though the mass of broken stone may vary greatly from place to place, hand-loading units may be employed at many places simultaneously. As the rock is unloaded into bins or railroad cars the successive dumping of quarry cars loaded at different places results in a mixture of uniform composition.

Methods of Quarrying Steeply Inclined Variable Beds—In mountainous districts, as, for example, in the Appalachian belt of eastern United States, limestone beds are rarely flat-lying, earth pressure having folded them until the beds in many places stand at steep angles. If successive steeply inclined beds vary in composition, though still within the limit of purity demanded for furnace use, the production of a uniform fluxing stone may involve considerable difficulty. Usually the quarry face is maintained in one of two positions, either parallel with the strike or outcrop of the beds or at right angles to the strike.

Where the face is maintained parallel with the strike it advances across the beds with each successive blast. Thus new beds may be encountered and some beds formerly used may disappear. If the successive beds vary in composition, evidently each advance will cause fluctuations in quality. Similarly if the quarry is deepened new beds will be encountered and old beds will successively disappear.

Where the face is maintained at right angles to the strike with each successive blast the same beds are encountered in exactly the same relative position, and the average composition of the rock from the entire face should not change appreciably as the quarry is enlarged. For uniform production, therefore, it is desirable that the face be maintained at right angles to the strike.

Another factor on which uniform mixing depends is the loading method. If a single power shovel is employed it can work at only one place at a time, and the composition of the rock loaded will undoubtedly fluctuate as the shovel advances from point to point on a wide face. If several shovels load at intervals along the face more uniform mixing is attained. If hand loaders work at successive points along the entire face, and the quarry cars are unloaded in proper succession, it is probable that more uniform mixing of the rock can be attained by this method than by the use of mechanical loaders.

If the usable beds are of limited thickness so that a narrow face must be main-

tained, the desired uniformity in the product may be obtained by deep-hole blasting and by loading with either power shovel or hand methods.

In summarizing the methods of obtaining uniform flux from steeply inclined variable beds it may be emphasized that the quarry face should be maintained at right angles to the strike of the outcrop, that the rock should be thrown down in a single bench across the entire face wherever practicable, and that a loading method be pursued which will further mix and uniformly proportion the rock fragments from the various beds.

Influence of Mining Methods—As noted in a recent bulletin* of the Bureau of Mines there is a marked tendency toward underground mining of limestone. The most noteworthy effect of this method is the increased purity of the stone obtained. In mining it is customary to follow the desirable beds only, and thus avoid the introduction into the product of rock from impure strata. Furthermore, as the whole process of stripping is avoided there is no contamination from surface debris. Operators of mines have been able to find a fluxing market for their fine materials, for they have been able to convince the furnace operators that their fines are just as pure as their lump rock. The general tendency of underground limestone mining is to produce metallurgical stone of a high degree of purity and uniformity.

By-Product Industries

Usually the quarryman prefers a single market for his product, a market all the details of which he thoroughly understands. A diversity of markets requires an additional sales force, and a knowledge of the requirements of other consuming industries. However, conditions may be such that a diversity of products is unavoidable. Stone unsuited for metallurgical use may be so interbedded that its removal becomes a necessity, in which case it is highly desirable that a market be found for it. The crushed stone and railroad ballast industries may constitute favorable outlets. At practically all fluxing-stone quarries there is a surplus of fines. With suitable grinding equipment the fines may be prepared for the agricultural limestone market or for the filler trades. Coarser materials may be sold as chicken grit or as limestone sand in localities where silica sand is not abundant.

Metallurgical limestone is itself a by-product at many limestone quarries. Thus in the Toledo district of Ohio many thousands of tons of dolomite, too small in size for calcining to lime in shaft kilns, is sold to metallurgical plants for furnace lining.

Production Cost of Fluxing Stone

Conditions vary so greatly at different quarries that the individual items which make up the total quarry cost are exceedingly diverse, and the total cost at which metallurgical stone may be placed on the market likewise varies markedly in different localities. Therefore, it is a difficult matter to arrive at average costs of the various operations. Thoenen† arrived at a cost of 67 cents per ton as an average for 30 open-pit limestone quarries in various parts of the country. For an average quarry operating on a large scale these costs might be distributed as follows:

COST DISTRIBUTION

Operation	Cost in cents per ton
Stripping	6.0
Drilling	9.5
Explosives	7.5
Loading (hand)	22.0
Mucking	6.0
Transportation	5.0
Repairs, taxes, etc.	5.5
Interest and amortization	5.5
Total	67.0

If machine loading is employed, the direct loading cost would be much less than 22 cents, but considering the interest on investment and the crushing and screening subsequently required the total would probably differ little from the hand loading cost. It is important to emphasize that some of these items will be much higher and some much lower under the peculiar conditions of individual quarries. If an operator finds that a certain item is very much higher than the figure given above, he should direct special efforts toward developing economies in this particular process.

Thoenen's careful study of limestone mining led him to the conclusion that underground work costs on an average about 30 cents per ton more than open-pit work.

*Thoenen, J. R., "Underground Limestone Mining," Bulletin 262, 1926.

†Thoenen, J. R., work cited, p. 94.

Twenty Thousand Miles of Road of Surfaced Types Built in 1926

THE total length of surfaced roads constructed by state agencies during the year was 19,492 miles, of which 13,664 miles was laid over former earth roads and 5828 miles represented a rebuilding of old surfaces, according to reports of the Bureau of Public Roads, Department of Agriculture of the United States.

The reports show that the total mileage of surfaced roads in the state highway systems increased by 18,205 miles during the year; but of this increase 4541 miles represents no actual work by the states, but consists of mileage transferred from county to state jurisdiction, statistical changes resulting from resurveys, and like changes.

The above figures refer to increases in surfaced mileages on the state highway systems only and do not include surfacing laid by the counties or other local governments. They do include, however, all work done with federal aid.

The statistical table issued by the federal bureau shows that the combined state systems embrace 287,928 miles and that of this mileage 163,059 miles is surfaced and 28,456 miles is graded and drained according to engineering standards. The state systems are now about 66% initially improved. The types of surfaced roads existing at the end of 1926 were as follows:

MILEAGE OF SURFACED ROADS AT END OF 1926

	Miles
Sand-clay and topsoil	11,396
Gravel, chert and shale	79,286
Waterbound macadam	18,428
Bituminous macadam	12,927
Sheet asphalt	890
Bituminous concrete	4,815
Cement concrete	31,935
Brick	3,215
Asphalt, wood and stone block	165

The mileage of road in the state systems and the mileage surfaced are as follows:

State	Total mileage in state systems	Existing surfaced mileage at end of 1926	Mileage of new surfacing placed during year, including reconstruction
Alabama	3,936.3	2,172.5	467.2
Arizona	2,031.4	1,421.5	75.0
Arkansas	8,346.0	4,153.0	358.0
California	6,582.1	3,537.9	265.4
Colorado	8,966.6	3,499.3	295.3
Connecticut	1,952.1	1,819.3	200.0
Delaware	590.5	590.5	84.8
Florida	5,654.0	2,725.3	349.5
Georgia	6,258.8	2,664.5	327.6
Idaho	4,668.4	2,437.6	269.4
Illinois	9,459.6	4,495.5	361.8
Indiana	4,262.6	4,155.3	376.7
Iowa	6,653.7	3,469.6	498.7
Kansas	7,887.0	1,338.5	403.5
Kentucky	9,646.6	4,192.1	197.6
Louisiana	8,000.0	4,707.2	594.5
Maine	1,574.8	1,306.1	135.1
Maryland	2,419.8	2,419.8	148.1
Massachusetts	1,563.7	1,550.9	102.8
Michigan	6,756.8	6,229.3	354.1
Minnesota	6,930.9	6,353.5	1,412.0
Mississippi	6,721.0	3,839.0	458.6
Missouri	7,640.0	3,375.8	822.7
Montana	7,957.2	926.9	119.2
Nebraska	6,256.0	2,764.1	833.8
Nevada	2,996.0	1,022.6	189.7
New Hampshire	2,256.6	1,963.4	169.4
New Jersey	1,457.8	1,296.9	50.5
New Mexico	9,214.4	1,684.8	73.9
New York	14,068.0	9,853.8	565.6
North Carolina	6,218.0	5,464.0	696.2
North Dakota	6,837.8	1,335.4	539.4
Ohio	11,000.0	9,591.0	2,411.2
Oklahoma	5,589.0	1,584.5	236.1
Oregon	4,468.6	3,220.4	293.6
Pennsylvania	12,033.4	8,439.6	751.3
Rhode Island	821.7	451.5	49.9
South Carolina	5,143.3	3,869.9	584.1
South Dakota	5,923.5	2,467.8	444.8
Tennessee	5,051.0	3,555.5	291.7
Texas	18,728.0	9,256.3	497.1
Utah	3,248.7	1,189.8	150.0
Vermont	4,462.0	3,139.0	139.0
Virginia	5,210.5	3,839.0	165.8
Washington	3,283.6	2,607.3	96.2
West Virginia	3,784.6	1,732.3	494.0
Wisconsin	10,279.6	8,420.4	962.0
Wyoming	3,136.2	929.1	129.4
Total	287,928.2	163,059.3	19,492.3

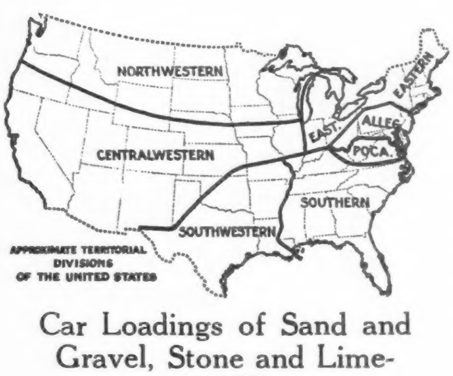
Coal Dust Explosion Tests

BULLETIN No. 268 of the Bureau of Mines, Department of Commerce, describes the work of the Bureau at its experimental mine in the Pennsylvania field from 1919 to 1924. Its interest to the rock products field comes from the fact that dusting with various rock dusts was tested. The experiments show that at least 55% of the dust accumulated in the mine should be inert rock dust and that this should be increased by 10% for each 1% of gas present where gas is found in the ventilating current.

The latter part of the bulletin contains specifications for rock dust and the recommended practice for using it to prevent explosions from the coal dust.

Traffic and Transportation

EDWIN BROOKER, Consulting Transportation and Traffic Expert
Munsey Building, Washington, D. C.



Car Loadings of Sand and Gravel, Stone and Limestone Flux

THE following are the weekly car loadings of sand and gravel, crushed stone and limestone flux (by railroad districts), as reported by the Car Service Division, American Railway Association, Washington, D. C.:

CAR LOADINGS OF SAND, GRAVEL, STONE AND LIMESTONE FLUX

	Limestone Flux Week ended		Sand, Gravel and Stone Week ended	
District	June 18	June 25	June 18	June 25
Eastern	4,346	4,481	16,113	16,818
Allegheny	3,612	3,804	11,617	11,807
Pocahontas	761	717	1,193	1,205
Southern	599	548	13,185	13,115
Northwestern	1,732	2,140	11,384	10,650
Central West'n	532	633	11,633	11,903
Southwestern	322	327	6,851	6,177
Total	11,904	12,650	71,976	71,675

COMPARATIVE TOTAL LOADINGS, BY DISTRICTS, 1926 AND 1927

	Limestone Flux		Sand, Gravel and Stone	
	1926	1927	1926	1927
	Period to Date		Period to Date	
District	June 26	June 25	June 26	June 25
Eastern	77,396	77,617	167,873	181,368
Allegheny	92,325	88,469	141,398	157,265
Pocahontas	10,599	10,586	18,891	18,239
Southern	16,906	13,711	284,378	287,408
Northwestern	31,892	33,740	116,500	136,642
Central West'n	12,042	12,596	199,920	202,888
Southwestern	6,276	7,827	121,553	127,812
Total	247,436	244,546	1,050,513	1,111,622

Comparative Total Loadings 1926 and 1927

	1926	1927
Limestone flux	***247,436***	***244,546***
Sand, stone, gravel	***1,050,513***	***1,111,622***

Proposed Changes in Rates

THE following are the latest proposed changes in freight rates up to the week beginning July 17:

SOUTHERN FREIGHT ASSOCIATION DOCKET

34902. **Crushed stone**, etc., from southeastern points and Kinsey, N. C., to Burlington and Ft. Madison, Iowa. Combination rates now apply. Proposed rates to Burlington and Ft. Madison, Iowa, in cents per net ton:

From—	Rate	Description
Tate, Ga.	529	A
Whitestone, Ga.	529	C
Mineral Bluff, Ga.	520	E
Kinsey, N. C.	529	E
Bolivar, Ga.	529	H
Fairmount, Ga.	529	H
Marmor, Tenn.	493	I
Tellico Plains, Tenn.	511	H
Knoxville, Tenn.	493	J
Brownson, Ala.	529	K
Gantt's Quarry, Ala.	529	K

Descriptions

A—Marble, crushed, in bags, carloads, minimum weight per Note 1.

C—Stone, crushed, carloads, minimum weight as per Note 1.

E—Marble or limestone, crushed, in barrels, bags or in bulk, carloads, minimum weight as per Note 1.

H—Stone or slate, crushed, carloads, minimum weight as per Note 1.

I—Stone, marble or slate, broken or crushed, carloads, minimum weight as per Note 1.

J—Stone, marble or slate, broken or crushed, and marble spalls, carloads, minimum weight as per Note 1.

K—Marble, crushed, carloads, minimum weight as per Note 1.

Note 1—Minimum weight 90% of marked capacity of car, except where cars are loaded to their full visible capacity, actual weight shall govern.

The rate proposed from Whitestone is the same as that applicable to Rock Island and Moline, Ill. From Tate, Ga., Kinsey, N. C., Bolivar, Fairmount, Ga., Brownson and Gantt's Quarry, Ala.—Same as the rate proposed from Whitestone, Ga.; from the other origins mentioned, proposed rates are made with relation to suggested rate from Whitestone, Ga.

34903. **Stone, agricultural**, from Franklin, Tenn., to L. & N. R. R., N. & D. Division stations, between West Harpeth and Columbia, Tenn., inclusive. It is proposed to establish the following reduced rates on—Stone, agricultural (ground or crushed limestone), carloads, minimum weight 60,000 lb., from Franklin, Tenn., to the following Tennessee points, in cents per net ton:

West Harpeth	63	Carters Creek	72
Midwest	*	Dark's Mill	72
Thompson	63	Godwin	81
Spring Hill	72	Columbia	81
Kleburne	72		

*Station abandoned.

Proposed rates are made the same as rates applicable from and to other points on the L. & N. R. R. for comparable distances.

34913. **Sand and gravel** from Cairo and Metropolis, Ill., to Gibbs, Rives, Dyersburg, Martin, Milan, Jackson and Grand Junction, Tenn. Mileage or combination rates now apply. Proposed rates on—sand and gravel, straight or mixed, minimum weight 90% of marked capacity of the car, except when cars are loaded to their visible capacity, in which case the actual weight shall apply, carloads—from Cairo, Ill., to the destinations mentioned, 10c per ton higher than from Paducah, Ky.; from Metropolis, Ill., 30c per ton higher than from Paducah, Ky.

34933. Granite or **stone, crushed** or rubble, from Boxley, Va., to Pinners Point, Va. It is proposed to establish reduced rate of 95c per net ton on—Granite or stone, crushed or rubble, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity actual weight will govern—from Boxley, Va., and intermediate points of origin from which higher rates are today maintained—to Pinners Point, Va., and other points of destination intermediate to which rates are at present provided.

34943. **Sand, gravel**, chert, slag, etc., from, to and between points on the N. C. & St. L. Ry. It is proposed to revise the present rates on sand, gravel, chert, slag, crushed stone, rubble stone and broken stone, including ballast, from, to and between points on the N. C. & St. L. Ry., also between points on this line, on the one hand, and points on other trunk lines in southern territory on basis of the scale prescribed by the Interstate Commerce Commission in Docket 17517.

35017. **Sand and gravel**, Chattanooga, Tenn., to Alabama City and Gadsden, Ala. Present rate, 102c; proposed rate on sand and gravel, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight will govern, from Chattanooga, Tenn., to Alabama City and Gadsden, Ala., 80c per net ton, same as rate in effect from Gadsden, Ala., to Chattanooga.

35027. **Sand and gravel**, from Montgomery, Jackson's Lake, Prattville Junction, Oktamulka and Coosada, Ala., to Guin, Ala. It is proposed to establish reduced intrastate rate of 156c per net ton on sand and gravel, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity actual weight will govern, from the origins mentioned to Guin, Ala., made on basis of Birmingham, Ala., combination, using Birmingham, Ala., the L. & N. R. R. local rate and beyond the proportion required by the delivering line.

35057. **Gravel**, from Camden, Tenn., to M. & O. R. R. stations, viz.: McNairy, Bethel Springs, Selmer, Ramer and Guys, Tenn. Present rate, 113c per net ton. Proposed rate on gravel, carloads (not subject to Rule 34 of Classification), minimum weight as shown in Item 425, N. C. & St. L. Ry., I. C. C. 3065-A, from Camden, Tenn., to destinations mentioned above, 97c per net ton, to apply on intrastate traffic. Same as rate in effect to opposite stations on the G. M. & N. R. R., also same as rate applicable from Elco and Gravel Pit, Ill.

35103 (see note). **Sand, gravel and crushed** stone, rubble stone, broken stone, slag, chert and crushed slate, carloads, between points in southern territory. The Interstate Commerce Commission, in Docket 17517, prescribed single and joint line mileage scales for application between certain specified points within the south. Carriers, with certain exceptions, propose to revise all interstate rates between southern points (except Florida) on basis of the scales prescribed by the commission in Docket No. 17517. Statement showing the proposed scales will be furnished upon request.

Note—Public hearing on this subject will be held in the association offices Tuesday, July 26, 1927, instead of Monday, July 25, 1927.

TRUNK LINE ASSOCIATION DOCKET

15605. **Stone, crushed** or broken, and stone screenings, carloads, minimum weight 90% of marked capacity of car, except when car is loaded to cubical or visible capacity actual weight will apply, from Faulkner, W. Va., to Berrysburg, W. Va., $1.25; Flemington, W. Va., $1.35 per ton of 2000 lb.; Galloway, W. Va., $5 per car over proposed rates to Flemington, W. Va. Reason: Proposed rates are 10c per ton over the present Public Service Commission of West Virginia scale, prescribed in Case No. 1307.

15623. **Sand** or **gravel**, carloads, minimum weight 90% of marked capacity of car, except when car is loaded to cubical or visible capacity actual weight will apply, from Carpenterville, N. J., to Holland, N. J., 50c per ton of 2000 lb., subject to Rule 77. Reason: Proposed rate is comparable with rate from and to points in the same general territory, as per C. R. R. of N. J. Tariff I. C. C. G2909 and Reading Co. Tariff I. C. C. 309.

15627. **Crushed stone**, carloads, minimum weight 90% of marked capacity of car, except when car is loaded to cubical or visible capacity actual weight will apply, from Blakeslee, N. Y., to South Bay, N. Y., 70c per ton of 2000 lb., subject to Rule 77. Reason: Proposed rates are comparable with rates from and to points in the same general territory.

15636. **Crushed stone**, trap rock, mine rock, broken stone and stone screenings, in bulk, carloads, minimum weight 90% of marked capacity of car, except when car is loaded to cubical or visible capacity actual weight will apply, from Millington, N. J., to Blairstown, Johnsonburg, N. J., 81c, and Franklin, N. J., 92c per ton of 2000 lb. Reason: Proposed rate compares favorably with rate from Millington, N. J., to local stations on the D. L. & W. R. R. for similar distances, as per D. L. & W. R. R. Tariff I. C. C. 21371.

15652. **Sand**, other than blast, engine, foundry, molding, glass, silica, quartz or silex, carloads, minimum weight 90% of marked capacity of car, except when car is loaded to cubical or visible capacity actual weight will apply, from Morrisville and Tullytown, Penn. Proposed rates in cents per 2000 lb. To Lenni, Penn., 105; from Masonville to South Pemberton, N. J., Lenni, Penn., 105; Clifton to Media, Penn., 105; Elwyn to Glen Riddle, Penn., 105. Reason: To establish rates which will be comparable with those in force between points in the same general territory, as per P. R. R. Tariff, G. O.-I. C. C. 14342.

15685. **Lime, agricultural** and land, carload, minimum weight 30,000 lb., from Mt. Pleasant, Penn. Proposed rates in cents per 100 lb.

To the following Pennsylvania points:		Pittsburgh	8
		Leatherwood	11
New Alexander	7½	Cramer	13
McKeesport	8	Sabinsville	16

Reason—Proposed rates are comparable with rates now in effect on like commodities from and to points in the same general territory.

15688. **Crushed stone**, carloads, minimum weight 90% of marked capacity of car, except when car

is loaded to cubical or visible capacity, actual weight will apply, from Port Deposit, Md., to Farnhurst, Del., 80c per ton of 2000 lb., subject to Rule 77. Reason—Proposed rate is comparable with rates now in effect from and to points in the same general territory, as per P. R. R. Tariff G. O. I. C. C. 11899.

15699. **Crushed stone** and screenings, carloads, minimum weight 90% of marked capacity of car, except when car is loaded to cubical or visible capacity, actual weight will apply, from Jordanville, N. Y., to stations on the N. Y. O. & W. Ry, rates ranging from $1.25 to $2.05 per ton of 2000 lb. Reason—Proposed rates are the flat Birdsboro scale for joint line mileage as per I. C. C. Docket 13662.

1720. **Gravel**, carloads, minimum weight 90% of marked capacity of car, except when car is loaded to full visible or cubical capacity, actual weight will apply, from Staffordville and Cox's, N. J., to Ship Bottom, Beach Arlington and Brandt Beach, N. J., 50c; Beach Haven, N. J., 63c per ton of 2000 lb., rates to expire December 31, 1927. Reason—Proposed rates compare favorably with rates from and to points in the same general territory, as per Reading Co. Tariff, I. C. C. No. 309, and C. N. J. Tariff, I. C. C. No. 2909.

15721. Agent Wilson in his I. C. C. A157 provides for rates on **sand**, blast, common, engine, glass, molding and ground flint, from Berkeley Springs-Hancock-Mapleton-Round Top District to C. F. A. territory, including 67 to 78% points under general group basis and specific group basis. Tariff also publishes specific commodity rates in Items 3630 ton and including 3690. The destination points in these items are located in percentage groups 67 to 78% inclusive. It is proposed to provide suitable reference under the general group basis and specific group basis restricting such rate, applying from Berkeley Springs-Hancock-Mapleton and Round Top districts to points taking 67 to 78% group. Reason—Proposal will have the effect of eliminating possibility of fourth section departures.

15722. **Crushed stone**, carloads, minimum weight 90% of marked capacity of car, except when car is loaded to cubical or visible capacity, actual weight will apply, from Swimley, Wadesville, Stephenson, Shenandoah Boxboard Corp., Kearnstown, Bartonville and Stephens City, Va., to Winchester, Va., 70c per ton of 2000 lb. Reason—Proposed rates compare favorably with rates from Martinsburg and Millville, W. Va.

NEW ENGLAND FREIGHT ASSOCIATION DOCKET

12659. **Sand**, common, building, or run of bank, carloads, minimum weight 90% of marked capacity of car, except when the combined weight of the car and lading exceeds the published maximum weight limits, in which case the minimum weight will be the maximum weight that can be transported via the direct route to the destination point without exceeding the maximum weight limit, from Olneyville, R. I., to stations on the N. Y., N. H. & H. R. R., rates proposed as follows, in cents per 100 lb.:

Miles	Rate	Miles	Rate
1 to 30, inc.	3½	121 to 150, inc.	7
31 to 60, inc.	4½	151 to 180, inc.	7½
61 to 95, inc.	5	181 to 200, inc.	8
96 to 120, inc.	6	201 to 360, inc.	9

Reason: To provide same rates as are currently effective from other sand pits.

12686. **Gravel**, run of bank or screened or crushed, carloads, minimum weight 60,000 lb., from Milton, N. H., to Kittery Navy Yard Station, Maine, 80c per ton of 2000 lb. Also common building **sand**, carloads, minimum weight 60,000 lb., to Kittery Navy Yard Station, Maine, from Biddleford, Maine, 80c, and from Portland, Maine, 85c per ton of 2000 lb. Reason: To meet motor truck competition.

WESTERN TRUNK LINE DOCKET

2030A. **Crushed rock or stone** and ground limestone, carloads, minimum weight 90% of marked capacity of car, except that when actual weight of shipment loaded to full visible capacity of car is less than 90% of marked capacity of car, the actual weight will apply, but in no case less than 40,000 lb., from **Humboldt, Kan.**, to stations in Missouri, Kansas, Iowa and Nebraska, to which rates are named in M.-K.-T. R. R. Tariffs 3015-I and 5745-D, from Chanute, Kan. Present—From Humboldt, Kan., to Kansas points are as per M.-K.-T. Tariff 3100-H, also combination rates apply in joint line hauls; to Missouri points, are as per M.-K.-T. Tariff 3100-H; there are no through rates to points in Iowa and Nebraska, combination rates apply. Proposed—**Establish Chanute, Kan.**, rates from **Humboldt, Kan.**, to points in Iowa, Nebraska, Missouri and Kansas to which rates are now in effect in M.-K.-T. Tariffs 3015-I and 5745-D.

6149. **Sand, gravel**, sand and gravel pit strippins, **crushed** rubble or rip rap **stone**, stone quarry strippings, chatts or cinders. Minimum weight 90% of marked capacity of car, except that when weight of shipment loaded to full visible capacity of car is less than 90% of marked capacity, the actual weight will apply, but in no case shall the minimum weight be less than 40,000 lb., between Milwaukee, Wis., group and Beloit, Janesville and Madison, Wis., groups. Present, 4c per 100 lb. (on interstate traffic only).; proposed, 4½c per 100 lb. (on interstate traffic only).

CENTRAL FREIGHT ASSOCIATION DOCKET

16023. To establish on **crushed stone**, carloads, from Melvin, Ohio, to following Ohio points, rates in cents per net ton:

	Prop.	Pres.		Prop.	Pres.
Mariemont	90	100	Batavia	100	110
Clare	90	100	Afton	100	110
Newton	90	100	Williamsburg	100	110
Perintown	95	100	Eastwood	100	110
Gernon	95	100	Mt. Oreb	105	110

16061. To establish rate on **sand** other than blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica, **and gravel**, carloads, Urbana, Ohio, to Vandalia, Ohio, rate of 85c per net ton. Present rate, sixth class. Routing—Via C. C. C. & St. L. Ry., Troy, Ohio, B. & O. (west).

16062. To establish rate on **sand** other than blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica, **and gravel**, carloads, Brevoorts, Ind., to Harrisburg, Ill., rate of 101c per net ton. Present rate, 6th class, basis of 14½c.

16067. To establish on **sand**, viz.: Blast, engine, foundry, glass, loam, marl, molding and silica, carloads, Centreton and Campbells, Ind., to Indiana, also to Chicago and Danville, Ill., rates as shown in exhibit A attached. Present rates as shown in exhibit A attached.

Exhibit "A"

From Centreton and Campbells, Ind., to the following Indiana points:

	Pres.	Prop.		Pres.	Prop.
Alexandria	$1.64	$1.50	Lafayette	$2.02	$1.50
Anderson	1.64	1.50	Lebanon	1.64	1.25
Attica	2.62	1.50	La Porte	2.14	2.02
Auburn	2.39	2.39	Logansport.	1.64	1.50
Bedford	1.64	1.50	Marion	1.76	1.50
Bluffton	......	1.76	Mich. City	2.14	2.02
Cambridge City	1.51	1.50	Montpelier	......	1.76
Chicago*	2.02	1.90	Muncie	1.64	1.50
Connersville	1.51	1.50	New Castle	1.64	1.50
Crawfordsville	1.64	1.40	Pendleton	1.64	1.50
Danville*	2.02	1.54	Plymouth	2.02	1.90
Delphi	2.02	1.50	Richmond	1.64	1.50
Elwood	1.64	1.50	Rochester	2.14	1.76
Frankfort	1.64	1.40	Rushville	1.51	1.50
Greensburg	1.76	1.50	Seymour	1.51	1.50
Hartford City	2.14	1.50	Terre Haute	1.51	1.40
Kokomo	1.64	1.50	Washington	1.76	1.50
			Winchester	1.64	1.50

*Illinois.

16071. To establish on **sand**, other than blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing loam, molding or silica) **and gravel**, carloads, Rochester, Penn., to Freedom, Penn. Rate of 60c per ton of 2000 lb. Present rate, 70c per ton of 2000 lb.

16073. To establish on **sand** (other than blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica) **and gravel**, from Volant, Penn., to New Wilmington and Hermitage, Penn. Rate of 70c per ton of 2000 lb. Route, via P. R. R., Wilmington Junction and Sharpsville R. R. Present, 6th class.

16076. To establish a rate of 80c per 2000 lb. (see note) on **sand** (all kinds) **and gravel**, carloads, Barberton, Ohio, to Warren, Niles, Youngstown and Girard, Ohio.

Note—When shipments move in box cars the rate will be 92c per 2000 lb.

Present rate—90c per 2000 lb.

16080. To establish on **sand and gravel**, in open top cars, carloads, Marion, Ohio, to Dennison, Ohio, rate of 125c per net ton. Present rate, 6th class, 340c per net ton.

16081. To establish on **stone, crushed**, in bulk, in open top cars, carloads, Gibsonburg, Maple Grove and Woodville, Ohio, to Talmage, Ohio, rate of 125c per net ton. Present rate, 330c from Maple Grove, and 340c per net ton from Gibsonburg and Woodville, Ohio.

16091. To establish on **gravel and sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica), carloads, from Ambridge, Baden, Freedom and Rochester, Penn., to Trauger, Penn. Rate of 125c per ton of 2000 lb. Present rate—Ambridge, Penn., 16c; Baden, Freedom and Rochester, Penn., 17c.

ILLINOIS FREIGHT ASSOCIATION DOCKET

4123. **Sand and gravel**, carloads, from Chillicothe, Ill., to Edwards, Ill. Rates in cents per net ton—Present, 100; proposed, 95.

4120. **Sand, gravel** and gravel pit strippings and cinders, carloads, from South Beloit, Ill., Beloit, Janesville and Riton, Wis., to Lombard and Villa Park, Ill. Rates per net ton: present, $1.35; proposed, $1.10.

Recent I. C. C. Decisions

19006. Commission should find unreasonable and prejudicial, rates on sand and gravel from eastern Ohio points and from Follansbee, W. Va., to destinations in Pennsylvania and West Virginia, and prescribe new rates for the future, in accordance with the following scale, per net ton, over the shortest route, via existing connections, embracing not more than three lines:

Distance	Rate cents
20 miles and under	60
40 miles and over 20	70
60 miles and over 40	80
80 miles and over 60	90
100 miles and over 80	100
125 miles and over 100	110
150 miles and over 125	120
175 miles and over 150	130
200 miles and over 175	140

I. and S. 2940. Schedules suspended from July 1, 1927, to January 1, 1928. The suspended schedules propose to increase the rates on lime, common, agricultural and fluxing, carloads, from various Ohio producing points to Savanna, Ill., and related points. The following tariffs are affected. Supplement No. 2 to the Baltimore & Ohio Railroad Co.'s I. C. C. No. W. L. 9728; Supplements Nos. 4 and 5 to the Pennsylvania Railroad Co.'s I. C. C. F-2045, and other schedules of individual carriers.

18303. Rates on **sand** from Price, Okla., to various destinations in Kansas and Missouri unreasonable, for the past, present and future, to the extent that they exceeded, exceed or may exceed the rates contemporaneously maintained on like traffic from Sand Springs, Okla., to the same destinations and award reparation.

Southwestern Sand and Gravel Rate Hearing

AFTER a rehearing of the sand and gravel rate case, in which arguments were made for the restoration of the former rates on these building materials, the railroad commission took the matter under advisement and will announce its decision later.

Low rates were in effect to Fort Worth from Bonner's Spur, Hart's Spur and Tarrant on the Rock Island and from Grand Prairie on the Texas and Pacific. The commission ordered their cancellation and the application of a straight mileage scale. Fort Worth made such vigorous complaint that the commission suspended the cancellation of the specials to that point pending a rehearing.

Later the commission will decide whether it will apply the straight mileage rates to and from all points in the Fort Worth-Dallas section or allow exceptions. In the latter event it will also determine whether the former rates will prevail or modified special charges slightly raised.

The railroads protest any decrease in their revenues and want the full tariff rates to apply. All lines affected were represented at the hearing.

Current Abstracts of Foreign Literature

Significance of Iron to Portland Cement. The author, Dr. Goslich, studied the degree of oxidation of iron in portland cement, making analyses of the raw materials and of the finished product. The procedure was extremely difficult because complete exclusion of the oxygen of the air was necessary.

The following was established:

1. The blue-black shale contains Fe_3O_4 which maintains its state due to the presence of bitumen.

2. As soon as the bitumen becomes slowly decomposed in the upper layers, due to contact with air, the material becomes yellow.

3. Yellow underburned clinker contains Fe_2O_3.

4. The grey-green clinker contains only traces of Fe_3O_4, the iron being present mainly as Fe_2O_3. This discovery was quite unexpected. The fact that iron oxide imparts to the clinker a grey-green color has not as yet received an explanation.

When Törnebom's microscopic studies led him to announce that portland cement was composed of four different substances, which were characterized by their crystals and were designated as alite, belite, etc., no mention was made of their chemical composition. It was only established that alite was the predominant crystalline form. Other scientists came to the conclusion that alite consisted only of lime and silica, while belite, celite, etc., also contain alumina and iron oxide.

Numerous attempts were now made to produce alite synthetically from lime and silica.

Dr. Goslich maintains that Dr. W. Dyckerhoff's dissertation did not solve the problem of the nature of portland cement. To prove his point he recounts the results of the latter investigation, which are:

1. $2CaO \cdot SiO_2$, fused in an oxy-hydrogen blast, has no hydraulic properties.

2. The so-called "residual" melt, consisting of $CaO \cdot Al_2O_3$, hardens, when mixed with water, but soon dissolves to form a paste.

3. The remaining CaO, which cannot be eliminated, is supposed to form a solid solution with $2CaO \cdot SiO_2$.

4. Substances 1 and 2, when fused, yield a clinker which does not approach the strength of ordinary clinker.

5. Substances 1 and 2 and 3% Fe_2O_3, obtained commercially, naturally yield a perfect portland cement.

The author is, therefore, convinced that portland cement is made up of four, instead of three, substances, which are: CaO, SiO_2, Al_2O_3, and Fe_2O_3.—*Zement* (1927), 446, 447.

Brinell Test for Hardness Applied to Stone. The Brinell test, which is the standard method for determining the hardness of metals, may be applied to stone, brick, plaster, mortar and other building materials. This application is explained in articles by Edouard Marcotte, consulting engineer, now being published in *Mines Carrieres et Grandes Entreprises.* The author is especially interested in the test when it is used to determine the hardness of crushed limestone which has been treated with silicate of soda and which is being used as road materials. He points out that the Moh scale of hardness, determined by scratching one mineral with another, is comparative without depending on any mathematical law, whereas the Brinell test rests on the law that the hardness of the substance treated is in inverse ratio to the squares of the diameter of the print of the ball used. In the tests given in the article a ball of 17.5 mm. was used and it was forced into the sample tested by a pressure of 500 kg.

New Czecho-Slovakian Specifications for Portland Cement—The Ministry of Public Works, in agreement with the other government departments, and after consulting manufacturers and consumers, framed a set of rules for testing and delivery of portland cement which must be followed in all supplies of cement for government works or those subsidized by government. They have been accepted as obligatory by the "Association of Czecho-Slovakian Cement Works" (Spolek Tovaren na Cement v Ceskoslovenske Republice).

All cement must be sold by weight, reckoning 100 kg. (220 lb.) gross weight as net. The normal weight of the bags of cement must be 50 kg. (110 lb.) and that of barrels 200 kg. (440 lb.). The allowances in the weights should not exceed 2%. The bags must not exceed 1.5% of the gross weight, and the barrels 6%. The receptacles must always bear the name of the maker, that of place of production, the brand "Portland Cement," and the weight. The test samples should weigh about 15 kg. (33 lb.). When the supplies are consigned in wagons samples shall be taken at random from barrels and bags, 1.5 kg. (3.3 lb.) from the former and 0.75 from the latter, thus bringing the weight of the sample to 15 kg. (33 lb.) for 300 quintals (30,000 lb.) of cement. Unless otherwise specified in the order, only slow-setting cement must be supplied, viz., cement which begins to congeal 60 min. after being mixed with water. Setting should finish in 15 hours. To examine the stability of volume the cakes of cement paste must be kept immersed in water for 28 days. The ground cement must pass through a copper wire sieve, with 900 meshes per sq. cm. (No. 76 American sieve), thickness of the wire being 0.1 mm. (.003937 in.), and only leave a residue on the sieve of 4% of the initial weight. On sieves with 4900 meshes (No. 175) and wire 0.05 mm. (.0019685 in.) thick, the residue must not exceed 25% of the weight of the cement. The cohesive strength is to be determined by resistance of normal mortar test pieces made by mixing one part of portland cement with three parts of standard sand and a corresponding quantity of water. The crushing strength must be 103 kg. per sq. cm. (1463 lb./in.^{2}) after 7 days, and 220 kg. (3124 lb./in.^{2}) after hardening in water during 28 days; then 250 kg. after mixed hardening for 28 days. The tensile strength must be 12 kg. per sq. cm. (170 lb./in.^{2}) after 7 days and 20 kg. (284 lb./in.^{2}) after 28 days, when the test pieces are immersed in water, and then 25 kg. (355 lb./in.^{2}) after mixed hardening for 28 days.—*Quarry and Surveyors and Contractors Journal.*

Ciment-Gaize. A cement that appears to have been very satisfactory in its resistance to the action of sea water and ground waters bearing sulphates, is made in France by mixing "gaize" with portland cement clinker and grinding so that only 13% to 15% remains on the usual "4900" sieve (about 175 mesh). Gaize is defined as a soft and porous sedimentary rock, clayey and carrying a high proportion of silica which is soluble in alkalies, with an (apparent) density around 1.5. It has been developed commercially in the Paris basin by the Societe des Cements Francais, who have been conducting researches on the material since 1897. The gaize must be burned somewhat for use in mixing with portland cement.

Articles in the *Revue des Materiaux de Construction,* March and April, 1927, describe the cement and give many figures which show the tensile strength for various periods up to 10 years, in contact with sea water, in the air and in fresh water. Some of these results show the highest strength in sea water. There is also a report showing the satisfactory state of blocks kept in sea water for 10 years. The cement is being employed on work at the ports of Havre, Saint-Malo, De Loriant, and at Pointe-de-Grave.

According to the analyses given the gaize contains about 80% SiO_2, 7% Al_2O_3, 3.2% Fe_2O_3, 2% of CaO, and 1% of MgO. Various mixtures of portland cement and gaize are mentioned. Preference is given in one place to a mixture containing 21% of gaize as giving the greatest strength with resistance to the action of sea water, but tests are shown on a mixture of 30% gaize and 70% clinker which seems to be satisfactory.

Impurities in Sand. The effect of clayey impurities in sand is studied by Marc Elber in an article in the *Revue des Materiaux de Construction,* March, 1927. He points out that the quality of the cement used has often been called in question when really the impurities in the sand were the cause of disintegration. The study takes into account the effect of impurities on the chemical analysis of the cement rather than the mechanical effect of such impurities.

Missouri Valley Aggregate Producers Meet

THE Missouri Valley Sand and Gravel Producers Association met in Kansas City, July 20. For the first time representatives of the largest crushed stone producing company were present, and although they were there as guests on this occasion, it seemed understood that they would work with the association on tests and other matters of common interest. Overproduction in the district was perhaps the topic discussed most earnestly, although a good deal of attention was given to impending changes in freight rates and the effect of general business conditions on the industry. An unusually complete testing of local aggregates was planned.

President N. C. Dunn, Arkansas City (Mo.) Sand and Gravel Co., opened the meeting without any preliminary remarks and introduced V. P. Ahearn, executive secretary of the National Sand and Gravel Association, who spoke on the possibility of freight rate changes and the matter of overproduction in the industry.

Freight Rates and Overproduction

Concerning freight rates, Mr. Ahearn said that the Interstate Commerce Commission would institute an investigation into sand, gravel and crushed stone rates in the states of Louisiana, Texas, Arkansas and Oklahoma. While only one of these states was in the Missouri Valley Association, producers in other states were bound to be interested, as whatever was done would serve as a precedent in fixing other rates in western states.

He reviewed the hearing of last year before the commission and said that in view of what was brought out at that time the national association would arrange for a meeting of interested producers so that traffic counsel might be employed. The matter was of more than local importance because the railroads were apparently determined to standardize sand, gravel and crushed stone rates and it would be wise for producers to watch these proceedings closely.

The members voted to send representatives to the hearing, which will be held in Dallas, Texas, probably about August 25. The president appointed J. M. Chandler, Price Sand Co., Tulsa, to represent Oklahoma; Fred Gaedes, Consumers Sand Co., Topeka, to represent Kansas, and John Prince, Stewart Sand Co., Kansas City, to represent Missouri.

The second part of Mr. Ahearn's address was on overproduction in the industry. He reviewed what had been said on overproduction at the recent meeting of the directors of the national association in Chicago (reported in the July 9 issue of Rock Products) and read a letter which Illinois producers had sent to the presidents of railroads in Illinois showing why any more plants in Illinois would hurt the railroads as well as the sand and gravel industry.

Some members of the association had thought that such action might be considered unlawful. Mr. Ahearn read extracts from supreme court decisions which set out what trade associations might and might not do. It was clearly shown that there was nothing in these decisions to prevent industrial groups giving publicity to a condition of overproduction in their businesses. The bituminous coal industry has repeatedly done this. There would seem to be no reason therefore why the sand and gravel industry should not use every legitimate means at its disposal to show that established plants are more capable of supplying any demand that may be placed upon them. There is no way of keeping a man from entering the business if he is determined to go into it, but he can be given fair warning that he is placing his investment in jeopardy and aggravating a situation already bad.

A long discussion followed and it was finally decided that the best way to meet the situation in the Missouri valley district would be to appoint a committee that would communicate with railroads, financial houses and others who might be interested in the starting of new plants and to show them how serious a condition of overproduction already exists. The committee chosen was made up of Frank Peck, Muncie Sand Co.; John Prince, Stewart Sand Co., and H. E. West of the West Sand Co., Muskogee, Okla.

W. M. Spencer of the recently organized Consumers Materials Co. was asked about conditions of overproduction in the stone business in the district. He said that his company had taken over the business of 17 stone producers and were operating 11 of them. That was too many and he thought about seven quarries would be able to supply the entire demand of the district.

To Test Aggregates in the District

E. E. Sholer, engineer of the association, spoke on the arrangements that were being made to test thoroughly the aggregates used in the district. This test would include not only strengths in compression and tension but resistance to wear, durability and resistance to freezing and thawing. Aggregates would include well graded and too fine sand, jig sands, clayey sands, clean stone, both hard and soft, sand-gravel stone with dust and shale and "haydite." The reason for such a series was that present specifications admitted aggregates which would pass the usual tension and compression tests and meet the grading requirements, and yet the condition of concrete paving slabs after a few years of wear showed that such aggregates were unfit for highway concrete. Hence tests must go farther into the characteristics of the aggregate and specifications be written more closely.

The tests would cost the association about $500 if they were made at the Kansas state laboratory at Manhattan, for the laboratory would match dollar for dollar with the association in sharing the expense. He pointed out the possibility that individuals in the association might be hurt, because findings would be given without favoring individual or industry.

This fact did not seem to deter the members from seeking the truth about their own and competitive materials and the matter was referred to the executive committee with power to act.

Reports from the Districts

H. E. Fisher (Glasgow Sand and Gravel Co., Glasgow, Mo.) reported conditions quiet in the Missouri river district, with little doing except road work. Sales had fallen about 25% from last year's sales, and the fall was wholly in general construction. R. J. Stewart (Pioneer Sand Co., St. Joe, Mo.) said the city paving business in St. Joe was good and building fair. Sales were about the same as 1926.

H. E. West reported for Oklahoma saying there had been no road work in his part of the state, although some was just starting. General construction was about the same. J. A. Daily, Osage Sand and Contracting Co., Osage, Okla., said that business was not so good as last year but prospects were good.

Frank Peck reported for Kansas City and the lower Kaw that Kansas City had been considerably overbuilt so business was not very good and prospects for the remainder of the year were poor. John Prince said that Kansas City producers were mainly interested to see that no more plants were built in an overplanted district.

Fred Gaedes reported from the upper Kaw that Topeka was very quiet and sales of all building materials were small. Wichita business was holding up well, with sales fully equal to last year.

Sandgravel Specifications

The material "sandgravel," a very coarse sand, is now being produced in some quantity in Kansas, and Engineer Sholer explained that under the new specifications it would probably make good concrete roads. It took more cement, the amount varying with the fineness modulus. Specifications called for 15% through 28-mesh to give more fines to fill the voids. The extra cement required varied from 1/8 bbl. to 1/4 bbl. per cubic yard. It sells for 85 cents per ton.

Sand-Lime Brick Production and Shipments in June

THE following data are compiled from reports received direct from 27 producers of sand-lime brick located in various parts of the United States and Canada. The number of plants reporting is two less than those furnishing statistics for the May estimate published in the June 25 issue. The statistics below may be regarded as representative of the entire industry, the reporting plants having over two-thirds the production capacity in the United States and Canada.

With one or two exceptions production and shipments show a decrease as compared with the figures for last month. One plant in the Middle West reports, "We shipped 119 cars of sand-lime brick in June, with total sales of over 2,500,000 brick. This sets a new high mark for us. Our plant operated at about 75% of capacity for about half of the month and about 90% for the balance." The situation in Florida remains unchanged. Stocks and unfilled orders, although the reports received were two less than those for May, show a substantial increase over last month. From all reports, business in general seems to be from fair to good.

Quoted prices from the manufacturers remain about the same as last month. The following are the average prices quoted:

Average Prices for June

Shipping point	Plant Price	Delivered
Detroit, Mich.	....	16.25
Detroit, Mich.	....	16.00
Minneapolis, Minn.	10.00	12.75
Sebewaing, Mich.	....	....
Toronto, Canada	13.50	16.00
Michigan City, Ind.	11.00	....
Menominee, Mich.	*11.00	†14.50
Milwaukee, Wis.	10.50	‡13.00
G'd Rapids, Mich.	12.50	15.00
Buffalo, N. Y.	12.25	16.50
Jackson, Mich.	12.25	....
Woburn, Mass.	....	16.00
Atlantic City, N.J.	14.00	....
New Orleans, La.	....	....
Syracuse, N. Y.	18.00	20.00
Dayton, Ohio	12.50	....
Albany, Ga.	10.00	....
Lake Helen, Fla.	10.75	....
Hartford, Conn.	14.00	....
Sioux Falls, S. D.	12.00	¶13.50@14.00
Saginaw, Mich.	11.50	....
Madison, Wis.	12.00	....
Lakeland, Fla.	....	....
Flint, Mich.	11.50	14.00
Detroit, Mich.	....	16.48
Toronto, Canada	....	15.00
Toronto, Canada	....	14.00

*Carloads. †Truck. ‡F.O.B. Milwaukee, Wis. ¶Local delivery.

The following statistics are compiled from data received direct from 27 producers of sand-lime brick in the United States and Canada:

Statistics for May and June, 1927

	*May	†June
Production	23,225,352	19,170,704
Shipments (rail)	8,195,711	7,552,500
Shipments (truck)	13,250,505	13,459,713
Stocks	8,739,717	9,742,577
Unfilled orders	17,237,000	18,293,000

*29 plants reporting. †Incomplete, one plant not reporting on stock and five plants not giving unfilled orders.

The Sioux Falls Pressed Brick Co., Sioux Falls, S. D., has contracts for supplying the brick for the J. Morrell Foster residence, the Schroyer clinic and the Sioux Falls sewer and water departments for manholes. There are perhaps other new contracts which have not been reported.

New Mixed Mortar Plant at Birmingham

THE new plant of the Blue Diamond Co., located on Avenue C and 34th street, Birmingham, Ala., began making deliveries of machine mixed mortar early in June. The company was organized by F. M. Taylor and Hayden Brooks, formerly with the Birmingham Slag Co., and is owned entirely by Birmingham capital. All materials used are purchased in the Birmingham district of Alabama. The plant has a capacity of 200 cu. yd. of mortar per day and especially equipped trucks are used for deliveries.—*The Dixie Manufacturer.*

Hoosac Valley Lime Co.'s New Plant to Have Oil Fired Rotary Kilns

WORK on the foundations for machinery and structures of the Hoosac Valley Lime Co.'s new plant at Adams, Mass., is proceeding rapidly, according to the *North Adams Transcript.* Two rotary Traylor kilns 150 ft. long and 8 ft. dia. are to be installed, and oil will be used as fuel. Wood is used as fuel in the present shaft kilns. It is expected that the output of both kilns will be more than 1000 bbl. of lime per day or five times the output of the present plant. Two oil storage tanks, holding 30,000 gals., and an auxiliary tank 35 ft. long and 6 ft. dia. are being erected.

The kilns are connected to dust collecting chambers and it is reported that these have been put up with a guarantee that no dust will escape to become a nuisance to the residents of Adams.

The kiln feed will be screened into three sizes and each size stored in a silo. These, and other silos for storing ungraded material and lime, are 20 ft. dia. and 63 ft. high. They are housed in a steel building with corrugated steel sides and are being erected by the Burrell Engineering and Construction Co., Chicago, Ill.

A new cooper shop, 100x30 ft., is being built, to be equipped with machinery for making steel barrels, by the Anchor Corrugated Construction Co., which is also putting up the house over the silos.

As the output is to be so largely increased, many improvements to the quarry are necessary. The principal one is a tunnel connection to the quarry to give better transportation facilities. A new air compressor is being installed in a new building which will also contain the blacksmith shop.

Regulation of Urban Quarries in Montreal

A LARGE delegation of quarry operators recently waited on members of the city executive committee of Montreal asking that the restrictions against quarries which will be imposed by the new quarry by-law be modified. Terms of the new regulation would prohibit the operation of quarries within certain distances of any house or building, and the operators complain that this would practically eliminate every quarry in the city, while throwing the trade to a few so placed that they would not be affected.

Alderman Jarry upheld the city's attitude in limiting the quarries, stating that he lived in a quarry neighborhood and that the effects on development of sections of the city in a vicinity of these establishments was detrimental.

Alderman Des Roches, on the other hand, stated that he would present the quarrymen's interests to the administration, and added: "If Alderman Jarry would have some 1500 people who depend on quarries for their living leave the city, while there are so many vacant houses, I certainly will not favor his attitude. I will do all in my power to prevent the passage of the sections of the by-law which will close so many quarries."

A lively tilt occurred between members of the delegation and Alderman Jarry as to the effects of quarries on the districts where they are located. The quarrymen maintained that the development and operation of quarries helped expansion of the city and pointed out Villeray ward, which Alderman Jarry represents, as an example.

M. J. Haney

M. J. HANEY, prominent engineer and industrial leader, president of the Point Anne Quarries near Belleville, and former president of the Canada Cement Co., and president of the Port Credit Brick Works, Ltd., died July 13 at the age of 73 years, following an operation at the Kingston General Hospital. He had been a resident of Toronto and Port Credit, but due to ill health he had been staying at Godfrey, Ont., for the past few months. Overtaken with a sudden illness, he was taken to the Kingston General Hospital for the operation from which he did not rally.

The late Mr. Haney was born in Galway, Ireland, was educated at Watertown, N. Y., and came to Canada in 1873. He was connected with the Canadian Pacific railway and took part in many of the important engineering projects connected with the construction of that railway. He was also connected with the engineering work in connection with the construction of the Soo canal. He had been president or a director of many Canadian industries and boat lines as well as of financial institutions.

A. C. and E. L. Morris Buy Interest in Arkansas Plant

A. C. MORRIS and his son, E. L. Morris, who formerly operated the Morris Crushed Stone Co.'s granite quarry, near Macon, Ga., have purchased a half interest in the Red River Crushed Stone Co., according to the *Democrat* of Little Rock, Ark. The quarry has been operated until recently by John O. Wilson of Searcy, Ark. It is at Red Rock, about 24 miles from Searcy, and has been producing 400 tons daily. The output will be increased to 1000 tons daily and E. L. Morris will be general manager. J. W. Trieschmann of Little Rock is also interested in the business.

Both A. C. and E. L. Morris are very well known in the crushed stone industry. Before going to Macon they were connected with the American Lime and Stone Co., of Bellefonte, Penn. John O. Wilson is equally well known as he has operated lime and crushed stone companies in Arkansas for a number of years. He is at the head of the St. Joe Lime Co., St. Joe, Ark.

Missouri Gravel Plant Sold

THE Caruthersville Sand and Gravel Co., operating on the river front just above Caruthersville, Mo., closed a deal recently with the Missouri Sand and Gravel Co., taking over all its equipment, business and good will and in future only the one concern will operate here. The purchasing company is owned by H. C. May of this city and J. W. Trieschmann of Little Rock, Ark., and the other was owned and operated by N. W. Helm.

The surviving concern was first established here several years ago by John A. Riggs and Mr. Helm later purchased an interest in it and was identified with it for a few years. Messrs. May and Trieschmann bought the business some four or five years since and are now again in control of the sand and gravel business alone. They are disposing of some of the extra equipment they have acquired and are retaining a part of it to use in their enlarged operations. — *Caruthersville* (Mo.) *Democrat.*

New 2500-Ton Crushing Plant at Marion, Ohio

AN entire new stone crushing plant, said to be one of the most complete and modern in the country and installed at a cost of approximately $150,000, was started in operation recently by the Ohio Blue Limestone Co. at its quarry 3½ miles north of Marion.

Installation of the new equipment was completed after more than a year's work, during which the quarry practically suspended operations.

The improved plant was necessary in order that the company may be able to supply the demand for its products, which is expected to come from all parts of Ohio and nearby states, officials of the company say.

The new plant will greatly increase the company's production capacity, enabling it to supply a wide market area. The company produces crushed stone and screenings for use in road construction and building.

The plant, located on the Likens road, east of the Bucyrus pike, is provided with excellent railway and transportation facilities to handle its output.

Present plans are to maintain an output of between 2000 and 3000 tons of stone and screenings daily. A trial run made shortly after operation was started indicated that this production could be maintained with the present equipment.—*Marion* (Ohio) *Star.*

W. L. Hodgkins

W. L. HODGKINS, head of the Brownell Improvement Co. of Chicago, was drowned in Georgian Bay, Wednesday, July 6. Two members of the crew of his yacht *Playboy* perished with him.

In company with his family and friends, Mr. Hodgkins was staying at his summer camp at McGregor bay. He had gone to Cutler to bring two girls from Chicago who were to be guests at the camp and a chartered yacht filled with other guests had preceded his boat and was near it when the accident occurred. The *Playboy* caught fire, it is surmised, from a leaking gas tank, and was in flames almost immediately. Mr.

Photo by Moffett, Chicago

W. L. Hodgkins

Hodgkins shouted for all to jump overboard and remained until the last, throwing cushions and other things that would assist them to float to those already in the water. He was a good swimmer, but it is supposed that the intensely cold water and the fatigue of helping others was too much for his strength. The girls escaped by swimming to an island a mile distant. The party cook and a guide escaped by clinging to the floating cushions.

Mr. Hodgkins was a native Chicagoan and was 52 years old. He was a graduate of Purdue University and joined the Brownell Improvement Co. soon after his graduation, remaining with it 30 years. He is survived by his wife and a son 21 years old, William Press Hodgkins.

The Brownell Improvement Co. operates a quarry at Thornton, Ill., which under the management of Mr. Hodgkins became one of the largest producers in the Chicago district.

Pacific Portland's New Unit Ready October First

THE new units of the plant of the Pacific Portland Cement Co., Consolidated, at Redwood City, Calif., will be ready by October 1, according to the Redwood City *Standard*. The production will then be increased from 2700 to 6000 bbl. per day. Work is being pushed, with day and night shifts employed.

This company has recently added another suction dredge, the *Texas*, to its marine equipment. It will be used in dredging the oyster shells from which cement is made at the Redwood City plant.

Louisiana Portland Plans Increased Output

PLANS are nearing completion for increasing the cement mill of the Louisiana Portland Cement Co. 50% above its present capacity, Lewis R. Ferguson, manager of the company, declared in an address at the Rotary Club luncheon in New Orleans, La.

The $3,000,000 plant was recently placed in operation, but officials of the company have been so impressed with the possibilities of New Orleans, as a result of their frequent visits here, said Mr. Ferguson, that an immediate expansion in output is under consideration.

The company soon expects to receive one of the finest pieces of floating equipment to be found in the South. A tug on the way here is equipped with a 500-hp. Diesel engine and will be used to handle the barge loads of material passing through the plant.

"The Industrial canal," said Mr. Ferguson, "is an ideal location for our plant. We could have found no better anywhere in this section. We are able to bring our limestone by water from a point on the Tombigbee river 100 miles above Mobile and combine with it the sludge from the water purification plant in this city."—*New Orleans* (La.) *Picayune.*

Georgia Has New Sand and Gravel Company

THE Standard Sand and Gravel Co. of Augusta, Ga., has been organized by F. Lewis Marshall and John D. Twigs of Augusta. It will operate at Blum on the line of the Georgia and Florida railway. Machinery has been ordered for a new plant and operations will begin as soon as possible, according to the *Augusta Chronicle.*

Lime Association Directors Confer

THE board of directors and executive committee of the National Lime Association held a joint conference at Washington, D. C., on July 15, whose main purposes was the foundation of a working plan for the association activity for the current year. A tentative operating program was drawn up which after approval of the board and committee will be submitted to the lime industry for acceptance. John F. Pollock, vice president of the Ash Grove Lime and Portland Cement Co., Kansas City, Mo., was elected chairman of the board of directors.

Start Operation at Chillicothe, Ill., Gravel Plant

THE new gravel plant of the Contractors' and Builders' Supply Co., located on the C. R. I. & P. R. R. at Chillicothe, Ill., has just been completed and is now producing washed sand and gravel. This is said to be one of the most modern plants in this field, having all of the newest and most improved facilities for producing and preparing sand and gravel. Six large concrete storage bins, 18 ft. dia., 45 ft. high, with a storage capacity of several thousand tons of prepared material, have been erected near the plant.

The material is now excavated by dragline, but a dredge and pumping outfit will be installed in the future, at which time the present production will be increased. All the machinery is electrically operated.

This plant is so located that if the deep waterway is put through barges can be loaded from the storage bins. It is said to be the only plant in the vicinity having access to the river for shipping purposes.

The company also operates a central loading station at its yards. This is equipped with bins and batchers for sand-gravel mixtures.

The officers and owners are James F. McElwee, president, and W. C. Gill, secretary and general manager, who also own and operate the Lake Erie Mining Co. located at East Peoria, Ill.—*Chillicothe* (Ill.) *Enquirer.*

White River Gravel Bed Owners Ask Higher Damages

TWO damage suits aggregating $646,700 against the city of Indianapolis, Ind., were filed in Marion county courts for damage to gravel beds in White river which will be occasioned by the flood prevention program. The litigation was in the form of appeals from damages awarded by the board of public works.

Dilling & Co., Chocolate avenue and West Morris street, asked damages of $146,700 for a gravel bed and improvements near its plant. The board of works had awarded the company $55,550.

The second suit was brought by the Granite Sand and Gravel Co., of which W. K. Miller is president, and heirs of Nicholas McCarty. Damages in the amount of $500,000 are asked for three gravel beds near West Raymond street. The board of works had awarded them $61,787.75 damages.—*Indianapolis* (Ind.) *Star.*

Limitations of Water-Cement Specifications

THE June-July issue of the *Crushed Stone Journal*, published by the National Crushed Stone Association, contains a paper that advances considerably the field control of concrete. It is by A. T. Goldbeck, the director of the Bureau of Engineering of the association, and its title is Water-Ratio Specification for Concrete and Its Limitations. In the body of the paper stress is rightly laid on the limitations, and the necessity for doing this is sufficiently proven by the results obtained where the water-ratio specification alone was used and used in the most careful manner.

Mr. Goldbeck points out that the following factors have an influence on the strength of concrete, and some of them have quite as much of an influence as the water-cement ratio:

(a) Strength of cement.

(b) Grading and strength, surface characteristics and shape of either fine or coarse aggregate.

(c) Different combinations of either fine or coarse aggregate.

(d) Temperature of concrete during the curing period.

(e) Character of the curing and perhaps other conditions.

The water-cement strength relation put in the familiar equational form,

$$S = \frac{14{,}000}{7x}$$

is, as Mr. Goldbeck points out, only an average relation which does not apply to all conditions. The paper says:

"The water-ratio compressive strength relation is not a single relation. There is a series of such relations, each applying only to a particular set of conditions. In view of the fact that the average curve cannot be relied upon to give strength results entirely independent of the conditions under which the results are obtained, it is quite insufficient to use a water-cement ratio specification of the type quoted without some modification. The use of the same water-ratio does not necessarily produce concrete of the same strength."

In showing how this is true the paper lays considerable stress on the effect of temperature in curing and gives the results of McDaniels and Lord, charting the two to obtain an average curve. From this it is shown that the same concrete cured at a temperature of 40 deg. F. would have no more than 1610 lb. per square inch strength in compression, whereas if it had been cured at 80 deg. F. it would have had a compressive strength of 2760 lb. Comparison with the water-ratio curve shows that a change from 6.25 gal. of water to 8.25 gal. of water per sack of cement would produce the same variation if all other conditions were equal.

Taking all the factors affecting concrete into consideration, Mr. Goldbeck has drawn a specification that overcomes the deficiencies of the usual water-cement ratio specification. It probably will not be so popular as previous specifications, however, as the work required for the necessary data would take some time. In brief, the specification calls for the making of preliminary tests with the materials to be used. These are to include several water-cement ratio tests from which curves are to be plotted to be used on the job. Strength results are to be corrected for temperature by the use of the average curve. The remainder of the specification follows the standard water-cement specification.

Mr. Goldbeck has written with no idea of tearing down any of the work that has been done to establish the water-cement ratio theory. In fact, he uses this work ultimately in writing his specification. But he has assuredly done the engineering world a service in pointing out that any specification based on the water-cement ratio alone is insufficient and in showing how it is possible to overcome this insufficiency in field work.

Illinois Gas Tax to Speed Up Concrete Road Construction

ACCORDING to an interview with Frank Sheets, Illinois state highway engineer, published in Illinois local papers, the effect of the gas tax recently authorized by the state legislature will be to speed up the construction of concrete roads in the state. The program calls for 9800 miles of concrete road which will now be completed by 1934. Without the money available from the gas tax the program would not have been completed until 1942.

Half of the gas tax goes to the counties. Several rural counties are building concrete highways of half-width (9 ft.) on one side of the right of way, intending to add the other half later.

It appears that the passage of the gasoline tax law will add to the market for concrete aggregate and cement in both state and county construction.

D. S. McBride Advances

D. S. McBRIDE, manager of the Indiana Portland Cement Co., has been appointed vice-president and manager, according to announcement by H. Struckmann, president. Mr. McBride came to Indianapolis two years ago from New York, when the Indiana Portland Cement Co. was purchased by the International Cement Corp. He was assistant general manager in the New York office. He was appointed to his new position in accordance with the policy of the International company to fill all advances from within the organization.

Cement Products

TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

Handsome Home Built of Precast Units

California Residences of the Highest Type Being Constructed of Molded and Assembled Parts

EVER since the beginning of the concrete building unit industry there has been a desire on the part of manufacturers to introduce special forms that would give the designer a somewhat wider latitude by adapting concrete to particular styles of building. Many of these attempts have been failures. Some have been partial successes, such as the concrete lumber which may be placed so as to give the outside appearance of a colonial house with "ship-lap" over the sheathing. An example of this kind was shown in this section of ROCK PRODUCTS for October 30, 1926.

Recently, in California, some residences of the highest type have been built of precast units which are not of the usual block or tile form. Locally they are spoken of as being built of "concrete lumber," but the term is somewhat misleading. Special precast units would be closer to the mark. The various parts of the building are formed and precast from concrete instead of being worked from lumber by carpenters' tools, but the similarity is only one of form and not of construction.

Beautiful California home of precast concrete units used within and without

The photographs on this page show exterior and interior views of a residence built in this way at Del Mar, Calif. The architects were Requa & Jackson of San Diego.

The massive arched living room

Circular reception room

F. P. Daniels of Monrovia was the general contractor. All the interiors shown were made with precast slabs which were assembled as the parts of a "ready-cut" wooden house would be.

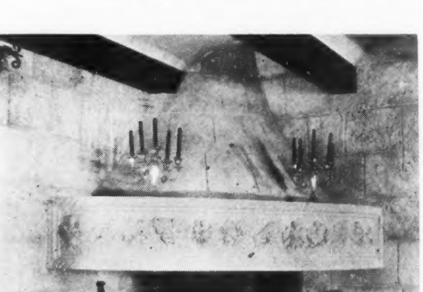
The cement used throughout was Monolith plastic waterproof portland cement, which is made at Monolith, near Los Angeles, Calif. This, while it it a portland cement, in that it meets A. S. T. M. specifications, has certain ingredients added during the grinding of the clinker which make the cement waterproof, and it is largely used on the west coast for exterior work.

The design of the house was carefully planned to fit into the landscaping scheme. The preferred building spots around southern California cities are now the tops of hills and the mountain sides where the so-called "contour designs" of buildings may be erected. The beauty of these designs is brought out by the setting which shows the profile of the building against the sky or against the dark green foliage of the mountain side. Often such homes are built on two or even more levels, and this is a kind of construction to which concrete would seem to be particularly well adapted.

Concrete in one form and another is the favorite California residence building material, as more than 60% of the homes in the state are built of concrete and stucco, according to recently published figures of construction.

Rear of the building showing the tower

The handsomely appointed dining room



Fireplace in a corner of the dining room

To Establish Cement Brick Plant at Savannah

PLANS for the location in Savannah of a cement brick and tile plant having a capacity of producing 75,000 bricks or 8500 sq. ft. of tile every eight hours, were announced recently by Benjamin B. Semilof, president of the Inter-American Brick & Tile Corp. of New York City. The location here of the brick plant depends upon whether or not Savannahians offer the required financial aid, Mr. Semilof stated.

As outlined by Mr. Semilof, it is planned to install $75,000 worth of machinery in a building measuring 50 x 100 ft.

The Inter-American Brick and Tile Corp., Mr. Semilof said, is capitalized at $2,500,000 and does an annual gross brick and tile business of between $3,500,000 and $4,000,000. The Newark Mirror Brick Corp. of Newark, N. J., is a subsidiary of the former corporation, and has a capitalization of $1,000,000, he said.

New plants are being built by the Inter-American corporation at Brooklyn and at Pinewald, N. J., Mr. Semilof stated. It is planned to erect a plant similar to these two at Savannah, providing the financial requirements are met here, he said.

Mr. Semilof stated that it would require about $75,000 for the erection of the plant in Savannah, and the installation of machinery necessary for manufacture.

The advantageous transportation facilities offered by Savannah, combined with cheap labor and power, make this city the logical place for the location of a brick and tile plant that would supply the entire eastern part of Georgia with its products, he declared.

All kinds of brick, and all sizes and colors of tiles, would be made in the proposed Savannah plant, Mr. Semilof stated.—*Savannah* (Ga.) *News*.

Concrete Units Tested in Brooklyn, N. Y.

THE Concrete Products Manufacturers Association, in conjunction with Albert E. Kleinert, superintendent, bureau of buildings, Brooklyn, N. Y., has just completed its public test on concrete building units for this borough. The tests are conducted under the supervision mentioned four times yearly.

The materials for test are gathered without notice from jobs in process of construction, an attempt being made to get samples of every manufacturer of these units on each test. This "pick-up" lasts two days and at the end a truck load of 150 samples are usually secured.

The samples are then put in charge of Prof. Wm. J. Moore of the Brooklyn Polytechnic Institute, who conducts the technical strength and water absorption test outlined in the building code of the city.

Successful samples must withstand a crushing strength of 95,000 lb. and not absorb more than 12% water.

The results of the last test of April 19, 20, 1927, are as follows: 44 different manufacturers tested; 69,500 units is the daily production of these firms, each unit equal to 13 bricks; firms representing 93% of this daily production successfully passed the tests.

Failing firms, of course, lose their license to continue manufacturing these building units under powers conferred by the building code on Supt. Kleinert.—*Brooklyn (N. Y.) Times*.

New Porous Concrete Meets With Success in Canada

"AEROCRETE," the Swedish porous concrete described in ROCK PRODUCTS, May 29 and December 11, 1926, is making considerable progress in Canada, according to Gustav V. Lang, consulting engineer of New York City. It has been specified, Mr. Lang says, for the new Royal Bank of Canada building which will require about 12,000 cu. yd. The progress in the United States is somewhat slower, the Porete Co., the American agents, reporting only a few roof jobs of this material.

Concrete Institute to Meet in Philadelphia

THE twenty-fourth annual convention of the American Concrete Institute will be held in Philadelphia at the Benjamin Franklin hotel, Tuesday, Wednesday and Thursday, February 28, 29 and March 1, 1928.

The annual conventions of the Institute from 1924 to 1927 inclusive were held in Chicago, the 1923 convention was held in Cincinnati, the 1922 convention in Cleveland, and the 1920 and 1921 conventions were held in Chicago so that there has been no meeting in the East since 1919.

Canadian Cement Shipped to South America

THREE THOUSAND tons of Canadian cement, bound aboard the SS. Wilston for Columbia, South America, left Montreal recently. The shipment is of importance in that it represents the first of a campaign to ship Canadian exports direct by Canadian steamers to South America ports. The Wilston is a first class steamer owned by a Toronto firm and with capacity for 5,000 tons of merchandise. Traffic from Columbia to Canada has begun to assume importance with the reception here of large quantities of crude oil direct by Canadian lines from South America for refining in Montreal.

Cinder Concrete Condemned

By A. T. Hawk
Engineer of Buildings
Chicago, Rock Island & Pacific, Chicago

CINDER CONCRETE was used extensively in buildings 20 years ago where light weight was desired, but its use has greatly decreased in recent years. I believe that there are few places where it is justified.

When the La Salle Street station of the Chicago, Rock Island & Pacific and the New York Central at Chicago was built in 1902, reinforced concrete slabs were used on the roof of the train sheds, which are 214 ft. wide and over 500 ft. long. These slabs were 2 ft. wide, 5 ft. long and about 3 in. thick, reinforced with triangular mesh. In order to lighten the weight the outer edges of the slabs were made of gravel concrete, while cinder concrete was used for the interior portions.

About 10 years after the station was built one of these concrete slabs failed, and an examination showed that all the slabs were showing deterioration to such an extent that it was necessary to replace them. In some of the slabs the reinforcement had entirely disappeared owing to corrosion, this action being hastened by the moisture from condensation on the under part of the slabs.

One of the serious objections to the use of cinders for concrete is the wide variation in their characteristics. If they consisted entirely of the residue from completely burned coal it is fair to assume that they might make a satisfactory coarse aggregate, but most of the cinders, especially those obtained from locomotives, are composed of coal which has passed through various stages of combustion, together with pieces of slate and other extraneous matter which has little strength. Cinders from such a source, when wet, are also apt to cause acids that soon cause the failure of the reinforcement, hence such concrete should not be used where strength is an important factor. Cinder concrete has been used for floors in fireproof buildings, but even for such purposes it is felt that other materials are to be preferred.—*Railway Engineering and Maintenance.*

Checking in Green Concrete

THE causes of checking in green concrete are akin to those that cause checking in all mortars and plasters and even in hardening mud. The volume changes as water is removed by drying out. Similarly, the volume is increased if water is absorbed. If drying out of absorption of water occurs uniformly throughout a road slab, for example, there is not much danger of checking, but non-uniformity in the concrete or in the materials of which it is made is liable to be one of the chief causes of checking.

According to T. J. Vitcenda of the Wisconsin Highway Commission, writing in *Roads and Streets,* some of the causes of checking are found to be:

1. Non-uniformity in the mixture. This may be caused by improper mixing in the mixer, which will result in variations in the consistency and in the richness of different portions of the batch.
2. The use of too much water in mixing, which is likely to produce variations in the consistency of the mass.
3. A prolonged working of the surface of the road, thus bringing to the top a rich mortar of fine sand which will shrink more than the leaner concrete beneath it as drying progresses.
4. In cool weather, and with cements which are slow in hardening, the rapid evaporation by dry wind.
5. Rapid drying due to direct exposure to the sun's rays.
6. A dry subgrade of variable absorptive capacity, or a subgrade which swells materially when wetted.
7. The use of an aggregate which contains particles varying widely in absorptive capacity. For example, in one instance it was reported that a limestone aggregate caused shrinkage cracks, whereas the use of a gravel under exactly similar conditions did not produce this effect.
8. The use of dirty aggregate.
9. The use of a very quick settling cement.

Any one or several of the above may be contributing factors in the checking of a pavement. In most cases several of the causes listed above work together to form the hair cracks. Probably the most important contributing factors in checking are the first three listed. It is doubtful whether No. 7 is as important as our first thought might lead us to believe. No. 6 may exert a considerable influence in some localities. The only protection against checking is the elimination of such factors as are under control of the engineer. Sometimes the elements play a part and it is practically impossible to take any corrective measures.

A concrete bridge near San Antonio, Tex. The rustic effect has been reproduced so faithfully in concrete that even with close observation it is difficult to distinguish it from real wood

The Rock Products Market

Wholesale Prices of Crushed Stone

Prices given are per ton, F.O.B., at producing point or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Buffalo, N. Y.	1.30	1.30	1.30	1.30	1.30	1.30
Chaumont, N. Y.	.50	1.75	1.75	1.50	1.50	1.50
Chazy, N. Y.	.75	....	1.60	1.30	1.30	1.30
Coldwater, N. Y.—Dolomite			1.50 all sizes			
Danbury, Conn.	2.25	2.25	2.00	1.75	1.50	....
Dundas, Ont.	3.04	1.05	1.05	.90	.90	.90
Frederick, Md.	.50@ .75	1.20@1.30	1.15@1.25	1.10@1.15	1.10@1.15	1.05@1.10
Munns, N. Y.	1.00	1.40	1.40	1.25	1.25	....
Northern New Jersey	1.60	1.50@1.80	1.30@2.00	1.40@1.60	1.40@1.60	....
Prospect, N. Y.	1.00	1.50	1.40	1.30	1.30	....
Walford, Penn.	....	....	1.35h	1.35h	1.35h	1.35h
Watertown, N. Y.	1.00	1.75	1.75	1.50	1.50	1.50
Western New York	.85	1.25	1.25	1.25	1.25	1.25
CENTRAL:						
Afton, Mich.	....	....	.50	.75	....	1.50
Alton, Ill.	1.85	....	1.85	....	....	....
Buffalo and Linwood, Iowa	1.10	....	1.45	1.25	1.30	1.30
Chasco, Ill.	1.00@1.30	....	1.00@1.15	....	1.00@1.15	....
Columbia, Krause, Valmeyer, Ill.	1.10@1.50	1.10@1.25	1.20@1.35	1.10@1.35	1.10@1.35	‖1.25
Flux (Valmeyer)	1.10@1.50	....	....	1.75	....	1.75
Greencastle, Ind.	1.25	1.25	1.15	1.05	.75	.95
Lannon, Wis.	.80	1.00	1.00	.90	.90	.90
Linwood, Iowa	.95e	....	1.50[1]	1.40[2]	1.30[3]	....
McCook, Ill.	1.00	1.25	1.25	1.25	1.25	1.25
River Rouge, Mich.	1.20	1.20	1.20	1.20	1.20	1.20
Milltown, Ind.	....	.90@1.00	1.00@1.10	.90@1.00	.85@ .90	.85@ .90
Mt. Vernon, Ill.	1.10@1.20	1.00	1.00	1.00	1.00	....
Sheboygan, Wis.	1.10	1.10	1.10	1.10	1.10	1.10
Stone City, Iowa	.75	....	1.15	1.05	1.00	1.00
St. Vincent de Paul, Que. (A)	....	1.35	.95	.85	.80	1.25
Toledo, Ohio	1.60	1.70	1.70	1.60	1.60	1.60
Toronto, Ont.	1.55	2.05	2.05	1.90	1.90	1.90
Waukesha, Wis.	.90	.90	.90	.90	.90	.90
Wisconsin Points	.50	....	1.00	.90	.90	....
Youngstown, Ohio	.70j	1.25l@1.35h	1.25l@1.35h	1.25l@1.35h	1.25l@1.35h	1.25l@1.35h
SOUTHERN:						
Alderson, W. Va.	.40	1.45	1.35	1.25	1.20	....
Atlas, Ky.	.50	1.00	1.00	1.00	1.00	1.00
Brooksville, Fla.	.75	....	2.65	2.65	2.40	2.00
Cartersville, Ga.	1.50	1.65	1.65	1.40	1.25	1.25
Chico, Tex.	1.00	1.35	1.25	1.20	1.10	1.00
El Paso, Tex.	1.00	1.00	1.00	1.00	1.00	....
Ft. Springs, W. Va.	.50	1.35	1.35	1.20	1.20	....
Graystone, Ala.		Crusher run, screened, $1 per ton				
Kendrick and Santos, Fla.		3½ in. and less, $1 per ton				
Ladds, Ga.	....	1.65	1.65	1.35	1.15	1.15
New Braunfels, Tex.	.60	1.25	1.10	.90	.90	.90
Rocky Point, Va.	.50@ .75	1.40@1.60	1.30@1.40	1.15@1.25	1.10@1.20	1.00@1.05
WESTERN:						
Atchison, Kan.	.50	1.90	1.90	1.90	1.90	1.80
Blue Springs & Wymore, Neb.	.25	1.45	1.45	1.35c	1.25d	1.20
Cape Girardeau, Mo.	1.25	....	1.25	1.25	1.00	....
Rock Hill, St. Louis Co., Mo.	1.30	1.35	1.35	1.30	1.30	1.50
Sugar Creek, Mo.	1.15*	1.60†	1.60‡	1.60§	1.00¶	....

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Branford, Conn.	.80	1.70	1.45	1.20	1.05	....
Duluth, Minn.	.90	2.25	1.75	1.55	1.35	1.25
Dwight, Calif.	1.00	1.00	1.00	.90	.90	....
Eastern Maryland	1.00	1.60	1.60	1.50	1.35	1.35
Eastern Massachusetts	.85	1.75	1.75	1.25	1.25	1.25
Eastern New York	.75	1.25	1.25	1.25	1.25	1.25
Eastern Pennsylvania	1.10	1.70	1.60	1.50	1.35	1.35
Knippa, Tex.	2.50	2.25	1,55	1.25	1.10	....
New Haven, New Britain, Meriden and Wallingford, Conn.	.80	1.70	1.45	1.20	1.05	1.05
Northern New Jersey	1.40	1.80	1.80	1.40	1.40	1.40
Oakland and El Cerito, Calif.	1.00	1.00	1.00	.90	.90	....
Richmond, Calif.	.75	....	1.00	1.00	1.00	....
San Diego, Calif.	.50@ .75	1.25@1.50	1.25@1.50	1.10@1.25	1.10@1.25	....
Springfield, N. J.	1.70	2.20	2.10	1.70	1.60	1.60
Toronto, Ont.	....	3.58@4.05	3.05@3.80	....	....	....
Westfield, Mass.	.60	1.50	1.35	1.20	1.10	....

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Berlin, Utley, Montello and Red Granite, Wis.—Granite	1.80	1.70	1.50	1.40	1.40	....
Columbia, S. C.—Granite	....	2.00	1.75	1.75	1.60	....
Eastern Penn.—Sandstone	1.35	1.70	1.65	1.40	1.40	1.40
Eastern Penn.—Quartzite	1.20	1.35	1.25	1.20	1.20	1.20
Emathla, Fla.		Crushed flint rock, 2.50 per cu. yd.				
Graystone, Ala.—Granite	.50	....	....	....	....	....
Lithonia, Ga.	.75a	1.75b	1.60	1.40	1.35	....
Lohrville, Wis.—Granite	1.65	1.70	1.65	1.45	1.50	....
Middlebrook, Mo.	3.00@3.50	....	2.00@2.25	2.00@2.25	....	1.25@3.00
Richmond, Calif.—Quartzite	.75	....	1.00	1.00	1.00	....
Rochester, N. Y.		Dolomite, all sizes, $1.50 per ton				
Somerset, Penn. (sand-rock)		1.50 to 1.85				
Toccoa, Ga.—Granite	.50	1.35	1.35	1.30	1.25	1.25

*¼ to ½ in. †¼ to 1 in. ‡¼ to 1¼ in. §¼ to 2¼ in. ¶Dust.
‖Rip rap per ton. (a) Sand. (b) to ⅛ in. (c) 1 in., 1.40. (d) 2in., 1.30. (h) Less 10c discount. (j) Less 10% net ton. (l) Less .05. (e) Agstone to June 15, 1927. [1] ¾ to ¼ in. [2] 1 to ¼ in. [3] 1½ to ¼ in. (A) Plus 4% sales tax. less 2% discount 30 days.

Agricultural Limestone

(Pulverized)

Alderson, W. Va. — Analysis, 90% $CaCO_3$; 50% thru 50 mesh	1.50
Alton, Ill.—Analysis 99% $CaCO_3$, 0.3% $MgCO_3$; 90% thru 100 mesh	4.50
Atlas, Ky.—90% thru 100 mesh	2.00
50% thru 100 mesh	1.00
Bettendorf and Moline, Ill.—Analysis, $CaCO_3$, 97%; 2% $MgCO_3$; 50% thru 100 mesh, 1.50; 50% thru 4 mesh	1.50
Blackwater, Mo.—100% thru 4 mesh	1.00
Branchton, Penn. — 100% thru 20 mesh; 60% thru 100 mesh; 45% thru 200 mesh	5.00
Brandon and Middlebury, Vt. — Pulverized, burlap bags, 6.00; paper, $5.00; bulk	4.00
Cape Girardeau, Mo.—50% thru 50-mesh	1.50
Cartersville, Ga.—50% thru 50-mesh	1.50
Charleston, W. Va.—Marl, per ton, bulk	3.00
Chaumont, N. Y.—Pulverized limestone, bags, 4.00; bulk	2.50
Chico, Tex.—50% thru 50 mesh, 1.75; 50% thru 100 mesh	2.25
Colton, Calif.—Analysis, 90% $CaCO_3$, bulk	4.00
Cypress, Ill.—90% thru 100 mesh	1.35
Ft. Springs, W. Va.—50% thru 4 mesh	1.50
Hillsville, Penn.—Analysis, 94% $CaCO_3$; 1.40% $MgCO_3$; 75% thru 100 mesh; sacked	5.00
Hot Springs and Greensboro, N. C.—Analysis, $CaCO_3$, 98-99%; $MgCO_3$, 42%; pulverized; 67% thru 200 mesh; bags	3.95
Bulk	2.70
(Paving dust)—80% thru 200 mesh, bags	4.25@ 4.75
Bulk	3.00@ 3.50
Jamesville, N. Y. — Analysis, 89.25% $CaCO_3$; 5.25% $MgCO_3$; pulverized, bags, 4.25; bulk	3.75
Joliet, Ill.—Analysis, 52% $CaCO_3$; 44% $MgCO_3$; 90% thru 100 mesh	3.50
Knoxville, Tenn.—80% thru 100 mesh, bags, 3.95; bulk	2.70
80% thru 200 mesh, bags, 4.25; bulk	3.00
Ladds, Ga.—Analysis, $CaCO_3$, 64%; $MgCO_3$, 32%; pulverized; 50% thru 50 mesh	1.50@ 2.75
Marblehead, Ohio — Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$; 60% thru 100 mesh; 70% thru 50 mesh; 100% thru 10 mesh; 80 lb. paper sacks, 5.00; bulk	3.50
Marlbrook, Va.—Analysis, 80% $CaCO_3$; 10% $MgCO_3$; bulk, 1.50; bags	3.00
Marl—Analysis, 90% $CaCO_3$; 10% $MgCO_3$; bulk, 2:25; bags	4.00
Marion, Va. — Analysis, 90% $CaCO_3$, pulverized, per ton	2.00
Middlebury, Vt. — $CaCO_3$, 99.05%; 50% thru 200 mesh; sacked	5.00@ 6.00
Milltown, Ind. — Analysis, 94.50% $CaCO_3$, 33% thru 50 mesh, 40% thru 50 mesh; bulk	1.35@ 1.60
Olive Hill, Ky.—90% thru 4 mesh	1.00
Piqua, Ohio—Total neutralizing power 95.3%; 99% thru 10, 60% thru 50; 50% thru 100	2.50@ 2.75
100% thru 10, 90% thru 50, 80% thru 100; bags, 5.10; bulk	3.60
99% thru 100, 85% thru 200; bags, 7.00; bulk	5.50
Rocky Point, Va.—Analysis, $CaCO_3$, 95%; 50% thru 200 mesh, burlap bags, 3.50; paper, 3.25; bulk	2.00
Syracuse, N. Y. — Analysis 89% $CaCO_3$; $MgCO_3$, 4%; bags, 4.25; bulk	2.75
Toledo, Ohio—30% thru 50 mesh	2.25
Watertown, N. Y.—Analysis, 96-99% $CaCO_3$; 50% thru 100 mesh; bags, 4.00; bulk	2.50
West Stockbridge, Mass. — Analysis, 90% $CaCO_3$, 50% thru 100 mesh; cloth bags, 4.75; paper, 4.25; bulk	3.25

Agricultural Limestone

(Crushed)

Alton, Ill.—Analysis, 99% $CaCO_3$, 0.3% $MgCO_3$; 50% thru 4 mesh	3.00
Atlas, Ky.—90% thru 4 mesh	1.00
Bedford, Ind. — Analysis, 98.5% $CaCO_3$, 0.5% $MgCO_3$; 95% thru 10 mesh	1.50

(Continued on next page)

Agricultural Limestone

Bridgeport and Chico, Texas—Analysis, 94% $CaCO_3$, 2% $MgCO_3$; 100% thru 10 mesh		1.75
50% thru 4 mesh		1.50
Chicago, Ill. — 50% thru 100 mesh; 90% thru 4 mesh		.80
Columbia, Krause, Valmeyer, Ill. — Analysis, 90% $CaCO_3$; 100% thru 4 mesh	1.10@	1.50
Cypress, Ill.—90% thru 50 mesh, 50% thru 100 mesh, 90% thru 50 mesh, 90% thru 4 mesh, 50% thru 4 mesh		1.35
Danbury, Conn.—Analysis, 79% $CaCO_3$, 11% $MgCO_3$; 60% thru 100 mesh; 80% thru 50 mesh; 100% thru 4 mesh; bags, 4.25; bulk		3.25
Dundas, Ont.—Analysis, 54% $CaCO_3$; $MgCO_3$, 43%; 50% thru 50 mesh		1.00
Ft. Springs, W. Va.—Analysis, 90% $CaCO_3$; 90% thru 50 mesh		1.50
Kansas City, Mo. — 50% thru 100 mesh		1.00
Lannon, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 99% thru 10 mesh; 46% thru 60 mesh		2.00
Screenings (¼ in. to dust)		1.00
Marblehead, Ohio—Analysis, 83.54% $CaCO_3$, 14.92¼ $MgCO_3$, 32% thru 100 mesh; 51% thru 50 mesh; 83% thru 10 mesh; 100% thru 4 mesh (meal) bulk		1.60
Mayville, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 50% thru 50 mesh	1.85@	2.35
McCook, Ill.—90% thru 4 mesh		.90
Middlepoint, Bellevue, Kenton, Ohio; Monroe, Mich.; Huntington and Bluffton, Ind.—Analysis, 42% $CaCO_3$, 54% $MgCO_3$; meal, 100% thru 4 mesh; 20% thru 100 mesh		1.50
Moline, Ill., and Bettendorf, Iowa—Analysis, 97% $CaCO_3$, 2% $MgCO_3$; 50% thru 100 mesh; 50% thru 4 mesh		1.50
Mountville, Va. — Analysis, 62.54% $CaCO_3$; $MgCO_3$, 35.94%, 100% thru 20 mesh; 50% thru 100 mesh, bags		5.50
Pixley, Mo. — Analysis, 96% $CaCO_3$; 50% thru 50 mesh		1.25
50% thru 100 mesh; 90% thru 50 mesh; 50% thru 50 mesh; 90% thru 4 mesh; 50% thru 4 mesh		1.65
River Rouge, Mich. — Analysis, 54% $CaCO_3$, 40% $MgCO_3$; bulk	.80@	1.40
Stone City, Iowa — Analysis, 98% $CaCO_3$; 50% thru 50 mesh		.75
Tulsa, Okla.—Analysis $CaCO_3$, 86.15%, 1.25% $MgCO_3$, all sizes		1.25
Waukesha, Wis.—90% thru 100 mesh, 4.50; 50% thru 100 mesh		2.30

Pulverized Limestone for Coal Operators

Hillsville, Penn., sacks, 4.50; bulk		3.00
Joliet, Ill.—Analysis. 54% $CaCO_3$; 42% $MgCO_3$; 90% thru 200 mesh; bulk		*3.50
Piqua, Ohio, sacks, 4.50@5.00; bulk	3.00@	3.50
Rocky Point, Va.—92% thru 100, mesh, bulk	2.25@	3.50
Waukesha, Wis.—90% thru 100 mesh, bulk		4.50

*Bags extra.

Glass Sand

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

Berkeley Springs, W. Va.	2.00@	2.25
Buffalo, N. Y.	2.00@	2.50
Cedarville and S. Vineland, N. J.—Damp		1.75
Dry		2.25
Estill Springs and Sewanee, Tenn.		1.50
Franklin, Penn.		2.25
Gray Summit and Klondike, Mo.	1.75@	2.00
Klondike, Mo.		2.00
Los Angeles, Calif.—Washed		5.00
Massillon, Ohio		3.00
Mendota, Va.	2.25@	2.50
Michigan City, Ind.		.35
Mineral Ridge and Ohlton, Ohio		2.50
Oceanside, Calif.		3.00
Ohlton, Ohio		2.50
Pittsburgh, Penn.	3.00@	4.00
Ridgway, Penn.		2.50
Rockwood, Mich.	2.75@	3.25
Round Top, Md.		2.00
San Francisco, Calif.	4.00@	5.00
Silica, Va.		2.50
St. Louis, Mo.		2.00
Sewanee, Tenn.		1.50
Thayers, Penn.		2.50
Zanesville, Ohio		2.50

Miscellaneous Sands

City or shipping point	Roofing sand	Traction
Beach City, Ohio		1.75
Columbus, Ohio		.15@ .30
Dresden, Ohio		1.00@ 1.25
Eau Claire, Wis.	4.25	

(Continued on next page)

Wholesale Prices of Sand and Gravel

Prices given are per ton, F.O.B., producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
EASTERN:						
Ambridge & So. H'g'ts, Penn.	1.25	1.25	1.15	.85	.85	.85
Attica and Franklinville, N. Y.	.65	.65	.65	.65	.65	.65
Boston, Mass.‡	1.40	1.40	2.25		2.25	2.25
Buffalo, N. Y.	1.10	1.05	1.05	1.05	1.05	1.05
Erie, Penn.		1.00*		1.50*	1.75*	
Leeds Junction, Me.		.50	1.75		1.25	1.00c
Machias Jct., N. Y.	.75	.75	.85	.75	.75	.75
Montoursville, Penn.	1.00	.85	.75	.75	.60	.60
Northern New Jersey	.50	.50	1.25		1.25	1.25
Portland, Me.		1.00	2.25		2.00	
Shining Point, Penn.			1.00	1.00	1.00	1.00
Somerset, Penn.		2.00				
South Heights, Penn.	1.25	1.25	.85	.85	.85	.85
Washington, D. C.†	.85	.85	1.70	1.50	1.30	1.30
CENTRAL:						
Aurora, Ill.		.40@ .50	.40	.50	.70	.70
Algonquin and Beloit, Wis.	.50	.40	.60	.60	.60	.60
Appleton and Mankato, Minn.		.45	1.25	1.25	1.25	1.25
Attica, Ind.			All sizes .75@.85			
Barton, Wis.		.50	.75	.75	.75	.75
Chicago district, Ill.	.70	.55	.55	.60	.60	.60
Columbus, Ohio¶		.75	.75	.75	.75	
Des Moines, Iowa	.40	.40	1.40	1.40	1.40	1.40
Eau Claire and Chippewa Falls, Wis.		.40	.65@1.00	1.00	.90	
Elkhart Lake, Wis.	.60	.40	.50	.50	.50	.50
Ferrysburg, Mich.		.50@ .80	.60@1.00	.60@1.00		.50@1.25
Ft. Dodge, Iowa	.85	.85	2.05	2.05	2.05	2.05
Grand Haven, Mich.		.60@ .80	.70@ .90	.70@ .90		.70@ .90
Grand Rapids, Mich.		.50		.80	.80	.70
Hamilton, Ohio	1.00	1.00	1.00	1.00	1.00	
Hersey, Mich.		.50		.70		.75
Humboldt, Iowa	.50	.50	1.50	1.50	1.50	1.50
Indianapolis, Ind.	.60	.60		.90	.75@1.00	.75@1.00
Joliet, Plainfield and Hammond, Ill.	.60	.50	.50	.60	.60	.60
Mason City, Iowa	.50@ .60	.50@ .60	1.30	1.30	1.20	1.20
Mankato, Minn.				1.25	1.25	1.25
Mattoon, Ill.			.75@.85 all sizes			
Milwaukee, Wis.	.96	.91	1.06	1.06	1.06	1.06
Moline, Ill.	.60@ .85	.60@ .85	1.00@1.20	1.00@1.20	1.00@1.20	1.00@1.20
Northern New Jersey	.40@ .50	.40@ .50	1.40	1.35	1.25	
Pittsburgh, Penn.	1.25	1.25	.85	.85	.85	.85
Silverwood, Ind.	.75	.75	.75	.75	.75	.75
St. Louis, Mo.	1.20	1.45	1.55a	1.45	1.45	1.45
Terre Haute, Ind.	.75	.60	.75	.75	.75	.75
Wolcottville, Ind.	.75	.75	.75	.75	.75	.75
Waukesha, Wis.		.45	.60	.60	.65	.65
Winona, Minn.	.40	.40	1.50	1.35	1.25	1.15
Zanesville, Ohio		.60	.50	.60	.80	
SOUTHERN:						
Charleston, W. Va.	1.40	1.40	1.40	1.40	1.40	1.40
Brewster, Fla.	.35@ .45		2.25			
Brookhaven, Miss.	1.25	.70	1.25	1.00	.70	.70
Chattahoochie River, Fla.		.70		1.75		
Eustis, Fla.		.50				
Ft. Worth, Texas	2.00	2.00	2.00	2.00	2.00	2.00
Knoxville, Tenn.	1.00	1.20	1.20	1.20	1.20	1.20
Macon, Ga.		.50			.90	.90
New Martinsville, W. Va.	1.00	.90@1.00		1.20@1.30		.80@ .90
Roseland, La.	.35	.25	1.25	1.25	.50	.50
WESTERN:						
Kansas City, Mo.		.70				
Los Angeles, Calif.	.40	.40	.25@1.00	.25@1.00	.25@1.00	.25@1.00
Oregon City, Ore.		1.25*	1.25*	1.25*	1.25*	1.25*
Phoenix, Ariz.	1.25	1.10	2.50	2.00	1.25	1.10
Pueblo, Colo.	.70	.60		1.20		1.15
San Diego, Calif.		.40@ .50	.80@1.00	.80@1.00	.65@ .80	.65@ .80
Seattle, Wash. (bunkers)	1.25	1.25	1.25	1.25	1.25	1.25

Bank Run Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
Algonquin and Beloit, Wis.			Dust to 3 in., .40			
Brookhaven, Miss.						.60
Burnside, Conn.	.75					
Chicago district, Ill.	.35					
Ferrysburg, Mich.						.65@1.00
East Hartford, Conn.	.75*					
Gainesville, Texas		1.00			.55	
Grand Rapids, Mich.				.50		
Hamilton, Ohio					1.00	
Hersey, Mich.				.50		
Indianapolis, Ind.		Mixed gravel for concrete work, at .65				
Lindsay, Texas		1.10			.55	
Macon, Ga.	.35					
Mankato, Minn.	.30					
Moline, Ill. (b)	.60	.60	Concrete gravel, 50% G., 50% S., 1.00			
Ottawa, Oregon, Moronts and Yorkville, Ill.			Ave. .60 per ton all sizes			
Roseland, La.					.50	
Somerset, Penn.		1.85@2.00		1.50@1.75		
St. Louis, Mo.			Mine run gravel, 1.55 per ton			
Summit Grove, Ind.	.50	.50	.50	.50	.50	.54
Winona, Minn.	.60	.60	.60	.60	.60	.60
York, Penn.	1.10	1.00				

*Cubic yd. ‡Delivered on job by truck. (a) ⅝-in. down. (b) River run. (c) 2½-in. and less. ¶By truck only. †Rewashed.

Core and Foundry Sands

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

City or shipping point	Molding, fine	Molding, coarse	Molding, brass	Core	Furnace lining	Sand blast	Stone sawing
Aetna, Ill.	....	....	....	.30@ .35	....	....	....
Albany, N. Y.	2.25	2.00	2.25	1.50	....	3.75g	....
Arenzville, Ill.	1.50@1.75	....	....	1.00	....	....	....
Beach City, Ohio	1.75	1.75	....	1.75	1.75@2.00	....	....
Buffalo, N. Y.	1.50	1.50	....	2.00@2.50	....	....	....
Columbus, Ohio	1.50@2.00	1.25@1.50	2.00	.30	1.75@2.00	2.75@4.50	....
Dresden, Ohio	1.50@1.75	1.25@1.50	1.50@1.75	1.00@1.25	....	....	....
Eau Claire & Chippewa Falls, Wis.	....	....	....	....	....	3.00	....
Elco, Ill.	Ground silica per ton in carloads—18.00@31.00						
Estill Springs and Sewanee, Tenn.	1.25	....	....	1.25	....	1.35@1.50	....
Franklin, Penn.	1.75	1.75	....	1.75	....	....	....
Kasota, Minn.	....	....	....	....	....	....	1.00
Klondike, Mo.	....	....	....	2.00	2.00	....	2.00
Massillon, Ohio	2.25	2.25	....	2.25	2.50	....	....
Mendota, Va.	Ground flint or silex—16.00@20.00 per ton						
Michigan City, Ind.	....	....	....	.30@ .35	....	....	....
Millville, N. J.	....	....	....	1.75b	....	3.50	....
Montoursville, Pa.	....	....	....	1.35@1.60	1.30	....	....
New Lexington, O.	2.00	1.25	....	....	....	....	....
Ohlton, Ohio	1.75b	1.75b	....	2.00b	1.75b	1.75b	....
Ridgway, Penn.	1.50	1.50	1.75@2.00c	....	....	....	....
Round Top, Md.	....	....	....	1.60	....	2.25	....
San Francisco, Calif.[1]	3.50†	5.00†	3.50†	3.50@5.00†	3.50@5.00†	3.50@5.00†	....
Silica, Va.	Potters' flint per ton, 9.00@10.00						
Thayers, Penn.	1.25	1.25	....	2.00	....	....	....
Utica, Ill.	.55	.65	....	.75	.75	....	....
Utica, Penn.	1.75	1.75	....	2.00	....	....	....
Warwick, Ohio	1.50*@2.00	1.50*@2.00	1.50*@2.00	1.50*@2.00	1.50*@2.00	....	....
Zanesville, Ohio	2.00	1.50	2.00	2.50	2.50	....	....

*Green. †Fresh water washed, steam dried. [1]Core, washed and dried, 2.50. (b) Damp. (c) Shipped from Albany. (g) Dry.

Crushed Slag

City or shipping point	Roofing	¼ in. down	½ in. and less	¾ in. and less	1½ in. and less	2½ in. and less	3 in. and larger
EASTERN:							
Buffalo, N. Y., Emporium, Erie and Dubois, Penn.	2.25	1.25	1.25	1.35	1.25	1.25	1.25
Eastern Penn.	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Northern N. J.	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Reading, Penn.	2.50	1.25	....	1.50	....	....	....
Western Penn.	2.50	1.25	1.50	1.25	1.25	1.25	1.25
CENTRAL:							
Ironton, Ohio	1.30*	1.80*	1.45*	1.45*	1.45*	....	....
Jackson, Ohio	1.05*	....	1.30*	1.05*	1.30*	1.30*	....
Toledo, Ohio	1.50	1.25	1.25	1.25	1.25	1.25	1.25
Youngst'n, O., dist.	2.00	1.25	1.35	1.35	1.25	1.25	1.25
SOUTHERN:							
Ashland, Ky.	1.45*	....	1.45*	1.45*	1.45*	....	....
Ruesens, Va.	2.50	1.00	1.25	1.25	1.25	1.15	1.15
City, Ala.	2.05	.80	1.35	1.25	.90	.90	.80
Longdale, Roanoke, Ruesens, Va.	2.50	1.00	1.25	1.25	1.25	1.15	1.15
Woodward, Ala.	2.05*	.80*	1.35*	1.25*	.90*	.90*	....

*5c per ton discount on terms.

Lime Products (Carload Prices Per Ton F.O.B. Shipping Point)

	Finishing hydrate	Masons' hydrate	Agricultural hydrate	Chemical hydrate	Ground burnt lime, Blk.	Ground burnt lime, Bags	Lump lime, Blk.	Lump lime, Bbl.
EASTERN:								
Berkeley, R. I.	....	....	....	....	....	....	....	2.00[5]
Buffalo, N. Y.	....	12.00	12.00	12.00	....	....	10.00	1.95[4]
Chazy, N. Y.	....	8.50	7.50	10.00	....	15.50[28]	8.50	14.00
Lime Ridge, Penn.	....	....	....	....	....	....	5.00[2]	....
Pittsburgh, Penn.	12.50	8.50	8.50	....	9.00	11.00	8.00	....
West Stockbridge, Mass.	12.00	10.00	5.60	....	....	....	....	2.00[12]
Williamsport, Penn.	....	....	10.00	....	....	....	6.00	....
York, Penn.	....	9.50	9.50	10.50	8.50	10.50	8.50	1.65[7]
CENTRAL:								
Afton, Mich.	....	....	....	....	....	....	8.40	1.35
Carey, Ohio	12.50	8.50	8.50	....	9.00	....	8.00	1.50
Cold Springs, Ohio	....	8.50	8.50	....	....	....	8.00	....
Cold Springs and Gibsonburg, Ohio	12.50	8.50	8.50	....	9.00	11.00	....	....
Huntington, Ind.	12.50	8.50	8.50	....	9.00	....	8.00	....
Luckey, Ohio	12.50	....	....	....	....	....	....	....
Milltown, Ind.	....	8.50@10.00	....	10.00[8]	....	....	8.50[22]	1.35[10]
Scioto & Marble Cliff, O.	....	8.50	8.50	9.50	8.25	.62½	7.50	1.50[29]
Sheboygan, Wis.	11.50	....	....	....	9.50	....	9.50	.95
Wisconsin points[6]	....	11.50	....	....	....	....	9.50	....
Woodville, Ohio	12.50	8.50	8.50	13.50	9.00	11.00	9.00	1.50[29]
SOUTHERN:								
Allgood, Ala.	12.50	10.00	....	....	8.50	....	8.50	1.50
El Paso, Texas	....	....	....	....	....	....	7.00	1.50
Graystone & Landmark, Ala.	....	9.00	9.00	9.00	....	....	8.00	1.35
Keystone, Ala.	....	9.00	....	9.00	8.00	1.30	8.00	1.35
Knoxville, Tenn.	20.25	9.00	8.00	8.00	8.00	1.25	8.00	1.35
New Braunfels, Tex.	18.00	12.00	10.00	12.00	10.00	....	9.50	....
Ocala, Fla.	....	11.00	10.00	....	....	....	11.00	1.40
Saginaw, Ala.	12.50	10.00	9.00	10.00	....	....	8.50	1.50
WESTERN:								
Kirtland, N. M.	....	....	....	....	....	....	15.00	....
Limestone, Wash.	15.00	15.00	10.00	15.00	16.50	16.50	16.50	2.09
Los Angeles, Calif.	19.00	19.00	14.00	....	16.20	....	12.50	2.50
Dittlinger, Tex.	....	12.00@13.00	....	....	....	....	9.50[8]	1.50[23]
San Francisco, Calif.	20.00	20.00	13.50	21.00	....	....	14.50[30]	2.15
Tehachapi, Calif.	....	....	....	....	11.80	....	....	....
Seattle, Wash.	19.00	19.00	12.00	19.00	19.00	....	18.60	2.30

[2] Net ton. [3] Wooden, steel 1.70. [4] Steel. [5] Per 180-lb. barrel. [6] Dealers' prices, net 30 days less 25c disc. per ton on hydrated lime and 5c per bbl. on lump if paid in 10 days. [7] 180-lb. net barrel, 1.65; 280-lb. net barrel, 2.65. [8] To 11.00. [10] To 1.50. [12] To 3.00. [22] To 9.00. [23] To 1.60. [28] Barrels. [29] F.o.b. Woodville. [30] To 16.50.

Miscellaneous Sands

(Continued)

City or shipping point	Roofing Sand	Traction
Estill Springs and Sewanee, Tenn.	1.35@ 1.50	1.35@ 1.50
Massillon, Ohio	....	2.00
Michigan City, Ind.	....	.30
Mineral Ridge, Ohio	*1.75	*1.75
Montoursville, Penn.	....	1.10
Ohlton, Ohio	a1.75	a1.60
Red Wing, Minn.	....	1.25
Round Top, Md.	2.25	1.75
San Francisco, Calif.	3.50	3.50
Thayers, Penn.	....	2.25
Warwick, Ohio	....	1.50a@ 2.00
Zanesville, Ohio	....	2.50

*Wet. (a) Green.

Talc

Prices given are per ton f.o.b. (in carload lots only), producing plant, or nearest shipping point.

Baltimore, Md.:
- Crude talc (mine run) .... 3.00@ 4.00
- Ground talc (20-50 mesh), bags 10.00
- Cubes 55.00
- Blanks (per lb.) .... .08
- Pencils and steel worker's crayons .... .08
- Per gross .... 1.00@ 1.50

Chatsworth, Ga:
- Crude talc, grinding 5.00
- Ground talc (150-200 mesh), bags 10.00
- Pencils and steel worker's crayons, per gross .... 1.00@ 2.50

Chester, Vt.:
- Crude talc (Dark, 3.50; Light, 4.00)
- Ground talc (150-200 mesh), bulk .... 8.00@ 9.50
- Including bags .... 9.50@10.50

Chicago and Joliet, Ill.:
- Ground (150-200 mesh), bags 30.00

Dalton, Ga.:
- Crude talc (for grinding) 5.00
- Ground talc (150-200 mesh), bags 12.00
- Pencils and steel worker's crayons, per gross .... 1.00@ 2.50

Emeryville, N. Y.:
- (Double air floated) including bags; 325 mesh 14.75
- 200 mesh 13.75

Hailesboro, N. Y.:
- Ground white talc (double and triple air floated) 200-lb. bags, 300-350-mesh .... 15.50@20.00

Herry, Va.:
- Crude (mine run) .... 3.50@ 4.50
- Ground talc (150-200 mesh), bulk .... 8.50@13.00

Joliet, Ill.:
- Ground talc (200 mesh) .... *20.00@30.00†
- *Off color. †White.

Keeler, Calif.:
- Ground (200-300 mesh), bags .... 20.00@30.00

Natural Bridge, N. Y.:
- Ground talc (125-200 mesh), bags .... 10.00@15.00

Rock Phosphate

Prices given are per ton (2240-lb.) f.o.b. producing plant or nearest shipping point.

Lump Rock

- Columbia, Tenn.—B.P.L. 65-70% .... 3.50@ 4.50
- Gordonsburg, Tenn.—B.P.L. 65-72% .... 3.75@ 4.50
- Mt. Pleasant, Tenn.—B.P.L. 72% 5.50
- Tennessee — F.o.b. mines, gross ton, unground brown rock, B.P.L. 72% 5.00
- B.P.L. 75% 6.00
- Twomey, Tenn.—B.P.L. 65%, 2000 lb. 8.00@ 9.00

Ground Rock

(2000 lb.)

- Centerville, Tenn.—B.P.L. 65% 8.00
- Gordonsburg, Tenn.—B.P.L. 65-70% .... 4.00@ 4.50
- Mt. Pleasant, Tenn.—B.P.L. 72.50% (14½% phosphorus) 9.50
- Twomey, Tenn.—B.P.L. 65% .... 8.00@ 9.00

Florida Phosphate

(Raw Land Pebble)

(Per Ton)

Florida — F.o.b mines, gross ton,
- 68/66% B.P.L., Basis 68% 3.25
- 70% min. B.P.L., Basis 70% 3.75

Mica

Prices given are net, f.o.b. plant or nearest shipping point.

Pringle, S. D.—Mine run, per ton 125.00
- Punch mica, per lb. .... .06
- Scrap, per ton, carloads 20.00

Rumney Depot, N. H.—Per ton,
- Mine run 360.00
- Clean shop scrap 25.00
- Mine scrap 22.00
- Roofing mica 30.00
- Punch mica, per lb. .... .12
- Cut mica—50% from Standard List.

Special Aggregates

Prices are per ton f.o.b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco-chips
Barton, Wis., f.o.b. cars		10.50
Brandon, Vt. — English pink, English cream and coral pink	*11.00	*11.00
Brandon grey	*11.00	*11.00
Brighton, Tenn.—All colors and sizes		§5.00
Buckingham, Que.—Buff stucco dash		12.00@14.00
Chicago, Ill. — Stucco chips, in sacks, f.o.b. quarries		17.50
Crown Point, N. Y.—Mica spar		9.00@10.00
Dayton, Ohio		6.00@24.00
Easton, Penn.—Green stucco		12.00@18.00
Green granite		14.00@20.00
Haddam, Conn.—Felstone buff	15.00	15.00
Harrisonburg, Va.—Bulk marble (crushed, in bags)	†12.50	†12.50
Ingomar, Ohio—Concrete facings and stucco dash		6.00@24.00
Middlebrook, Mo.—Red		20.00@25.00
Middlebury, Vt.—Middlebury white	‡9.00	‡9.00
Middlebury and Brandon, Vt.—Caststone, per ton, including bags		5.50
Milwaukee, Wis.		14.00@34.00
New York, N. Y.—Red and yellow Verona		32.00
Phillipsburg, N. J.—Royal		12.00@14.00
Virblend		10.00@12.00
Stockton, Calif.—"Natrock" roofing grits		12.00@15.00
Tuckahoe, N. Y.—Tuckahoe white	12.00	
Wauwatosa, Wis.		22.00@32.00
Wellsville, Colo. — Colorado Travertine Stone	15.00	15.00

*Carloads, including bags; L.C.L. 14.50.
†C.L. L.C.L. 17.00.
‡Carloads, including bags; L.C.L. 10.00.
§Bulk, car lots, minimum 30 tons.

Potash Feldspar

Auburn and Topsham, Me. — Color white; 90% thru 140-mesh	19.00
Bristol, Tenn.—Color, white; analysis, K_2O, 6 to 10%; Na_2O, 2½ to 4%; SiO_2, 68 to 78%; Fe_2O_3, 12 to 20%; Al_2O_3, 16.5 to 18.5%; 99% thru 200 mesh; bulk, depending on grade	14.50@18.00
Brunswick, Me.—Color, white; 98% thru 140 mesh, bulk	19.00
Buckingham, Que.—Color, white, analysis, K_2O, 12-13%; Na_2O, 1.75%; bulk	9.00
De Kalb Jct., N. Y.—Color, white, bulk (crude)	9.00
East Hartford, Conn.—Color, white, 95% thru 60 mesh, bags	16.00
96% thru 150 mesh, bags	28.00
East Liverpool, Ohio—Color, white; 98% thru 200 mesh, bulk	19.35
Soda feldspar, crude, bulk, per ton	22.00
Glen Tay Station, Ont.—Color, red or pink; analysis, K_2O, 12.81%; crude (bulk)	7.00
Keystone, S. D.—Prime white; bulk (crude)	8.00
Los Angeles, Calif.—Color, white; analysis, K_2O, 12.16%; Na_2O, 1.53%; SiO_2, 65.60%; Fe_2O_3, .10%; Al_2O_3, 10.20%; crude	10.05
Pulverized, 95% thru 200 mesh; bags, 22.00; bulk	20.00
Murphysboro, Ill.—Color, prime white; analysis, K_2O, 12.60%; Na_2O, 2.35%; SiO_2, 63%; Fe_2O_3, .06%; Al_2O_3, 18.20%; 98% thru 200 mesh; bags, 21.00; bulk	20.00
Penland, N. C.—Color, white; crude, bulk	8.00
Ground, bulk	16.50
Tenn. Mills—Color, white; analysis K_2O, 18%; Na_2O_3, 10%; 68% SiO_2; 99% thru 200 mesh; bulk	18.00
99% thru 140 mesh, bulk	16.00
Toronto, Can.—Color, flesh; analysis K_2O, 12.75%; Na_2O, 1.96%; crude	7.50@ 8.00

Chicken Grits

Afton, Mich. (Limestone), per ton	1.75
Belfast and Rockland, Me.—(Limestone), bags, per ton	‡10.00
Brandon and Middlebury, Vt.—Per ton	10.00
Cartersville, Ga.—(Limestone), per bag	2.00
Centerville, Iowa—(Gypsum), per ton	18.00
Chico, Texas — (Limestone), 100-lb. bags, per ton	8.00@ 9.00
Danbury, Conn.—(Limestone), bulk	6.00@ 7.00
Easton, Penn.—Per ton, bulk	3.00
Joliet, Ill.—(Limestone), bags, per ton	4.50
Knoxville, Tenn.—Per bag	1.25
Los Angeles, Calif.—(Feldspar), per ton	15.00
Gypsum, Ohio—(Gypsum), per ton	10.00
Limestone, Wash. — (Limestone), per ton	12.50
Marion, Va.—(Limestone), bulk, 5.00; bagged, 6.50; 100-lb. bag	.50
Rocky Point, Va.—(Limestone), 100-lb. bags, 50c; sacks, per ton, 6.00; bulk	5.00
Seattle, Wash.—(Limestone), bulk, per ton	10.00
Warren, N. H.—(Mica), per ton	3.85@ 3.90
Waukesha, Wis.—(Limestone), per ton	8.00
West Stockbridge, Mass.—(Limestone), bulk	‡7.50@*9.00
Wisconsin Points—(Limestone), per ton	9.00

*L.C.L. †Less than 5-ton lots. ‡C.L.

Sand-Lime Brick

Prices given per 1000 brick f.o.b. plant or nearest shipping point, unless otherwise noted.

Albany, Ga.	10.00@11.00
Anaheim, Calif.	10.50@11.00
Barton, Wis.	10.50@13.00b
Boston, Mass.	17.00*
Brighton, N. Y.	19.75*
Brownstone, Penn.	11.00
Dayton, Ohio	12.50
Detroit, Mich.	16.00*
Farmington, Conn.	13.00
Flint, Mich.	¶12.00@17.50*
Grand Rapids, Mich.	12.50
Hartford, Conn.	16.00@19.00*
Jackson, Mich.	12.25
Lakeland, Fla.	10.00@11.00
Lake Helen, Fla.	9.00@12.00
Lancaster, N. Y.	12.25
Madison, Wis.	12.50
Michigan City, Ind.	11.00
Milwaukee, Wis.	13.00*
Minneapolis and St. Paul, Minn.	10.00
Minnesota Transfer	10.00
New Brighton, Minn.	10.00
Pontiac, Mich.	13.50@14.50
Portage, Wis.	16.00
Prairie du Chien, Wis.	18.00@22.50
Rochester, N. Y.	19.75*
Saginaw, Mich.	13.50
San Antonio, Texas	16.00
Sebewaing, Mich.	12.00
Sioux Falls, S. Dak.	13.00c
South River, N. J.	14.00
Syracuse, N. Y.	18.00@20.00
Toronto, Canada	16.00*
Wilkinson, Fla.	12.00@16.00
Winnipeg, Canada	14.00

*Delivered on job. ¶Dealers' price. (b) Delivered to Milwaukee.

Portland Cement

Prices per bag and per bbl., without bags, net in carload lots.

	Per Bag	Per Bbl.
Albuquerque, N. M.	.86¾	3.47
Atlanta, Ga.		2.35
Baltimore, Md.		2.25
Birmingham, Ala.		2.30
Boston, Mass.	.52¾	2.13@2.23
Buffalo, N. Y.	.55	2.20@2.30
Butte, Mont.	.90¼	3.61
Cedar Rapids, Iowa		2.24
Charleston, S. C.		2.35
Cheyenne, Wyo.	.82¾	3.31
Cincinnati, Ohio	.58	2.32
Cleveland, Ohio		2.24
Chicago, Ill.	.51¼	2.05
Columbus, Ohio	.57¼	2.29
Concrete, Wash.		2.35
Dallas, Texas		2.00
Davenport, Iowa		2.24
Dayton, Ohio	.58¼	2.33
Denver, Colo.	.66¼	2.65
Des Moines, Iowa		2.05
Detroit, Mich.		2.15
Duluth, Minn.		2.04
Houston, Texas		2.00
Indianapolis, Ind.	.54¾	2.19
Jackson, Miss.		2.50
Jacksonville, Fla.		2.20
Jersey City, N. J.		2.13
Kansas City, Mo.		1.92
Los Angeles, Calif.		2.50
Louisville, Ky.	.55½	2.22
Memphis, Tenn.		2.50
Milwaukee, Wis.		2.20
Minneapolis, Minn.		2.12@2 22
Montreal, Que.		1 36
New Orleans, La.		2.20
New York, N. Y.	.48¼	1.93@2.03
Norfolk, Va.		2.07
Oklahoma City, Okla.		2.46
Omaha, Neb.		2.36
Peoria, Ill.		2.22
Philadelphia, Penn.		2.11@2.21
Phoenix, Ariz.	.81½	3.26
Pittsburgh, Penn.		2.04
Portland, Colo.		2.80
Portland, Ore.		2.60*
Reno, Nev.		2.91
Richmond, Va.		2.34
Salt Lake City, Utah	.70¼	2.81
San Francisco, Calif.		2.21
Savannah, Ga.		2.50
St. Louis, Mo.	.51¼	2.05
St. Paul, Minn.		2.12@2.22
Seattle, Wash.		2.50*
Tampa, Fla.		2.25
Toledo, Ohio		2.20
Topeka, Kan.		2.41
Tulsa, Okla.		2.33
Wheeling, W. Va.		2.12
Winston-Salem, N. C.		2.62

NOTE—Add 40c per bbl. for bags.
*Less 10c discount.

Mill prices f.o.b. in carload lots, without bags, to contractors.

	Per Bag	Per Bbl.
Albany, N. Y.		2.15
Buffington, Ind.		1.80
Chattanooga, Tenn.		2.45*
Concrete, Wash.		2.50
Davenport, Calif.		2.35
Detroit, Mich.		2.15
Hannibal, Mo.		1.90
Hudson, N. Y.		1.65
Leeds, Ala.		1.85
Mildred, Kan.		2.35
Nazareth, Penn.		1.95
Northampton, Penn.		1.75
Richard City, Tenn.		2.05
Steelton, Minn.		1.85
Toledo, Ohio		2.20
Universal, Penn.		1.80

*Including sacks at 10c each.

Gypsum Products—CARLOAD PRICES PER TON AND PER M SQUARE FEET, F.O.B. MILL

	Crushed Rock	Ground Gypsum	Agricultural Gypsum	Stucco Calcined Gypsum	Cement and Gauging Plaster	Wood Fiber	White Gauging	Sanded Plaster	Keene's Cement	Trowel Finish	Plaster Board ¼x32x36". Wt. 1500 lb. Per M Sq. Ft.	Plaster Board ⅜x32x36". Wt. 1850 lb. Per M Sq. Ft.	Wallboard, ⅜x32 or 48". Lgths. 6'-10', 1850 lb. Per M Sq. Ft.
Arden, Nev., and Los Angeles, Calif.	3.00	8.00u	8.00u	10.70u	10.70u					11.70u			
Centerville, Iowa	3.00	10.00	15.00	10.00	10.00	10.50	13.50			13.50			
Des Moines, Iowa	3.00	8.00	9.00	10.00	10.00	10.50	13.50	12.00	24.00	22.00	18.00	21.00	30.00
Detroit, Mich.					14.30o	12.30m		m9.00@11.00o					
Delawanna, N. J.						8.00		9.00			.14½	.15½	30.00
Douglas, Ariz.			6.00				15.00		40.00	13.50	35.00	45.00	
Grand Rapids, Mich.	2.75	6.00	6.00	8.00	9.00	9.00	17.50		24.55	20.00			
Gypsum, Ohio	3.00	4.00	6.00	8.00	9.00	9.00	19.00	7.00	24.50	20.00		15.00	30.00
Los Angeles, Calif.			7.50@9.50	11.50y									
Port Clinton, Ohio	3.00	4.00	6.00	10.00	9.00	9.00	21.00	7.00	30.15	20.00		20.00	30.00
Portland, Colo.				10.00									
San Francisco, Calif.			11.65m	13.40r	14.40r		15.40r						
Seattle, Wash.	6.40	10.00	10.00	13.00									
Sigurd, Utah									21.50				
Winnipeg, Man.	5.00	5.00	7.00	13.00	14.00	14.00					20.00	25.00	33.00

NOTE—Returnable bags, 10c each; paper bags, 1.00 per ton extra (not returnable).
(m) Includes paper bags; (o) includes jute sacks; (r) including sacks at 15c; (u) includes sacks; (y) sacks 15c extra, rebated.

Market Prices of Cement Products

Concrete Block

Prices given are net per unit, f.o.b. plant or nearest shipping point

City or shipping point	Sizes 8x8x16	8x10x16	8x12x16
Camden, N. J.	17.00	....	....
Cement City, Mich.		5x8x12—55.00¶	
Columbus, Ohio	18.00@20.00a	....	....
Detroit, Mich.	.16	....	.18
Forest Park, Ill.	18.00*	23.00*	30.00*
Grand Rapids, Mich.	15.00@16.00a	....	....
Graettinger, Iowa	.18@ .20	....	....
Indianapolis, Ind.	.13@ .15†	....	....
Los Angeles, Calif.¶	5¾x3½x12—55.00	7¾x3½x12—65.00	
Oak Park, Ill.	16.00@18.00	....	....
Olivia and Mankato, Minn.	9.50b	....	....
Somerset, Penn.	.20@ .25	....	....
Tiskilwa, Ill.	.16@ .18†	....	....
Yakima, Wash.	20.00*	....	....

*Price per 100 at plant. †Rock or panel face. (a) Face. ‡Delivered. ¶Price per 1000. (b) Per ton.

Cement Roofing Tile

Prices are net per sq. in. carload lots, f.o.b. nearest shipping point, unless otherwise stated.

Camden and Trenton, N. J.—8x12, per sq.

Red	15.00
Green	18.00
Chicago, Ill.—Per sq.	20.00

Cicero, Ill.—Hawthorne roofing tile, per sq.

	Chocolate, Red, Yellow, Gray, and Orange	Green, Blue
French and Spanish†	$11.50	$13.50
Ridges (each)	.25	.35
Hips	.25	.35
Hip starters	.50	.60
Hip terminals, 2-way	1.25	1.50
Hip terminals, 4-way	4.00	5.00
Mansard terminals	2.50	3.00
Gable finials	1.25	1.50
Gable starters	.25	.35
Gable finishers	.25	.35
*End bands	.25	.35
*Eave closers	.06	.08
*Ridge closers	.05	.06

*Used only with Spanish tile.
†Price per square.

Houston, Texas—Roofing Tile, per sq.	25.00
Indianapolis, Ind.—9x15-in.	Per sq.
Gray	10.00
Red	11.00
Green	13.00
Waco, Texas:	Per sq.
4x4	.60

Cement Building Tile

Cement City, Mich.:	Per 100
5x8x12	5.00
Grand Rapids, Mich.:	Per 100
5x8x12	8.00
5x4x12	4.50
Longview, Wash.: (Stone-Tile)	Per 1000
4x6x12	55.00
4x8x12	64.00
Mt. Pleasant, N. Y.:	Per 1000
5x8x12	78.00
Grand Rapids, Mich.:	Per 100
5x8x12	7.00
Houston, Texas:	
5x8x12 (Lightweight)	80.00
Pasadena, Calif. (Stone Tile):	Per 100
3½x4x12	3.00
3½x6x12	4.00
3½x8x12	5.50
Tiskilwa, Ill.:	Per 100
8x8	15.00
Wildasin Spur, Los Angeles, Calif. (Stone-Tile):	Per 1000
3½x6x12	50.00
3½x8x12	60.00
Prairie du Chien, Wis.:	
5x8x12	82.00
5x4x12	46.00
5x8x 6 (half-tile)	41.00
5x8x10 (fractional)	82.00
Yakima, Wash. (Building Tile):	
5x8x12	.10

Cement Drain Tile

Graettinger, Iowa—5 to 36 in., per ton	8.00
Olivia and Mankato, Minn.—Cement drain tile, per ton	8.00
Tacoma, Wash.—Drain tile, per ft.:	
3 in.	.04
4 in.	.05
6 in.	.07½
8 in.	.10
Waukesha, Wis.—Drain tile, per ton	8.00

Concrete Brick

Prices given per 1000 brick, f.o.b. plant or nearest shipping point.

	Common	Face
Appleton, Minn.	22.00	25.00@40.00
Baltimore, Md. (Delivered according to quantity)	15.50	22.00@50.00
Camden and Trenton, N. J.	17.00	....
Ensley, Ala. ("Slagtex")	14.50	22.50@33.50
Eugene, Ore.	25.00	35.00@75.00
Friesland, Wis.	22.00	32.00
Longview, Wash.*	15.00	22.50@65.00
Milwaukee, Wis.	14.00@15.00	20.00@40.00
Mt. Pleasant, N. Y.	....	14.00@23.00
Oak Park, Ill.	....	37.00@42.00
Omaha, Neb.	18.00	30.00@ 40.00
Pasadena, Calif.	10.00	....
Philadelphia, Penn.	14.75	20.00
Portland, Ore.	17.50	23.00@55.00
Mantel brick	100.00@150.00	
Prairie du Chien, Wis.	14.00	22.50@ 25.00
Rapid City, S. D.	18.00	25.00@40.00
Waco, Texas	16.50	32.50@125.00
Watertown, N. Y.	20.00	35.00
Westmoreland Wharves, Penn.	14.75	20.00
Winnipeg, Man.	14.00	22.00
Yakima, Wash.	22.50	....

*40% off List.

Current Prices Cement Pipe

Prices are net per foot f.o.b. cities or nearest shipping point in carload lots unless otherwise noted.

Culvert and Sewer	4 in.	6 in.	8 in.	10 in.	12 in.	15 in.	18 in.	20 in.	22 in.	24 in.	27 in.	30 in.	36 in.	42 in.	48 in.	54 in.	60 in.
Detroit, Mich.	15.00 per ton																
Graettinger, Iowa	.04½d	.05½	.08½	.12½	.17½	......	.40	.50	.60	.70	......	......	......	......	......	......	—
Gr'nd Rapids, Mich. (b)																	
Culvert pipe	......	......	......	.60	.72	1.00	1.28	1.60†	......	1.92	2.32	3.00	4.00	5.00	6.00	......	—
Sewer pipe (d)	......	......	......	......	......	.63	......	.60†	......	......	......	.58	......	......	......	......	—
Houston, Texas	......	.19	.28	.43	.55½	.90	1.30	......	1.70†	2.20	......	......	......	......	......	......	—
Indianapolis, Ind. (a)	......	......	......	.80	.90	1.10	1.30	......	......	1.70	......	2.70	......	......	......	......	—
Longview, Wash.	Sewer pipe 40% off list; culvert—list																
Mankato, Minn. (b)	......	......	......	......	......	......	......	......	......	1.50	1.75	2.50	3.25	4.25	......	......	—
Newark, N. J.	6 in. to 24 in., $18.00 per ton																
Norfolk, Neb. (b)	......	......	......	.90	1.00	1.13	1.42	......	......	2.11	......	2.75	3.58	......	6.14	......	7.78
Olivia, Mankato, Minn.	12.00 per ton																
Paullina, Iowa‡	......	......	......	......	......	......	......	2.25	......	2.11	......	2.75	3.58	......	6.14	......	7.78
Somerset, Penn.	......	......	......	......	1.08	1.25	1.65	......	......	2.50	......	3.65	4.85	7.50	8.50	......	—
Tacoma, Wash.	.15	.18	.22½	.30	.40	.55	.75	......	......	......	......	......	......	......	......	......	—
Tiskilwa, Ill. (rein.) (a)	......	......	......	.65	.75	.85	1.10	1.60	......	1.90	......	2.25	3.40	......	5.50	......	—
Wahoo, Neb. (b)	......	......	......	......	1.00	1.13	1.42	......	......	2.11	......	2.75	3.58	4.62	6.14	6.96	7.78
Yakima, Wash.	$10.00 per ton																

(a) 24-in. lengths; (b) Reinforced; (d) Eastern clay, list, 72% and 60% off.
†21-in. diam. ‡Price per 2-ft. length.

Longest Concrete Road

THE longest continuous stretch of concrete roadway in the world has been completed between White Bear and Duluth, Minn. This passes through 29 towns and villages over its 137-mile length. Construction was begun in 1923. Highway authorities point out that it will save a great deal of money, as maintenance costs for the former gravel surfacing on this highway have been as much as $3,000 a mile, state highway records show. This pavement is two miles longer than the concrete pavement extending from Olmypia to Vancouver.

Static and Impact Loads on Concrete Culverts

IN connection with the many phases of culvert investigations studied by the Iowa Engineering Experiment Station some work has been done with superimposed concentrated loads at rest and in motion in addition to the more extended research in determining loads due to earth fills and the supporting strength of pipes. The results have been gathered and published in Bulletin No. 79. The experimental results show that for heights of fill greater than 5 ft. the effect of ordinary highway track loadings on culverts of width not greater than 3.5 ft. may be neglected, since the load concentration reaching the culvert is very small in comparison with the load due to the filling material. For fills of 5 ft. and less, the effect of concentrated superimposed loads is appreciable and structures should be designed to carry these loads in addition to the load due to the embankment material. The amount of these transmitted loads may be calculated from the formula given in the bulletin.

The increase in load effect on the culvert when the superload becomes a moving load, varies from zero to several hundred per cent and depends mainly upon the character of the roadway over the culvert. Very high impact percentages were obtained by placing unusual obstructions in the wheel track. It is believed, however, that for ordinary highway conditions, an increase of 50% to 100% over the calculated static load effect will be sufficient to take care of the impact produced by moving trucks passing over culverts, up to speed of 10 miles an hour.

"Sandy" Pratt Expands Again

CLARENCE (SANDY) PRATT, whose clever advertising of rock, sand and gravel built up a big business on the Pacific coast, has bought new properties which he will develop. One is at Mayhew, near Sacramento, and the other is near Benica, Calif. His company has also built another large bunker for retail San Francisco trade.

Besides the above properties the Pratt Co. has sand, crushed rock and gravel plants at Sacramento, Marysville, Prattrock (near Folsom) and Prattco (Monterey county). The central office is in San Francisco and Howard W. Senter is secretary and Clarence (Sandy) Pratt is president of the four above named companies.

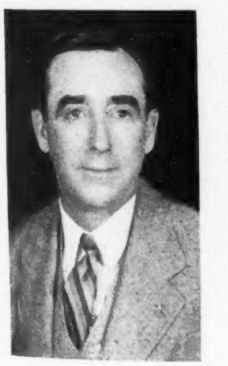
New Sand and Gravel Company in Enid, Okla.

ENID, Okla., is to have a new sand and gravel company, according to the *Enid Events*. It is capitalized at $50,000 and has a pit six miles south of Ringwood.

O. C. Calvert is president of the company; O. J. Fleming, vice-president; J. L. Neuner, secretary and general manager, and Ed Fleming, treasurer. The officers, with Glenn A. Walters, constitute the board of directors. The company's offices are in the Enid Bank and Trust Co.'s building.

Consulting Engineer Joins Manufacturing Organization

JEAN M. ALLEN, consulting engineer, of Chicago, has joined the organization of Hetherington and Berner of Indianapolis, Ind. He will continue his consulting work in Chicago and represent Hetherington & Berner in the design and sale of the equipment they manufacture.



J. M. Allen

Mr. Allen is internationally known as a designer and builder of dredges and gravel plants. In addition to his work in the gravel field he has designed and constructed some of the most important contractors' dredges in the United States. He knows the business not only from the designing but from the operating end, for he has had charge of dredges in the field and some of them were very large installations employed in river and harbor work.

Hetherington and Berner have been in business for 60 years and their line of pumps is well known in the industry. A full line of sand and gravel machinery will be built so that entire plants may be erected which are wholly the work of one designing engineer and of one manufacturing company.

Mr. Allen has been familiar with the sand and gravel industry since his boyhood and has developed a cutter, a hoist and other machines which are in regular use on gravel dredges. Some of his writings on dredge design and equipment have been published in ROCK PRODUCTS.

To Promote Glass Sand Deposits Near Reading, Penn.

PROF. HENRY WARD of Lehigh University, connected with special work of the state geologic survey, has spent several days in Reading, Penn., making a survey of the sand and gravel of this locality, in which work he was assisted by the Chamber of Commerce.

The chamber hopes to interest glass manufacturers in using local sand. This is part of a continuous industrial survey being conducted by the chamber and will be extended to other natural products of the county.—*Reading* (Penn.) *Eagle*.

Increased Shipments Foreseen for Mid-West Territory

SOME quickening in business activity in general in the mid-west in the coming three months, as contrasted with the same quarter last year, was indicated by reports of various commodity committees of the Mid-West Shippers' Advisory Board at the thirteenth regular meeting of that organization, held recently at Greenbay, Wis. The board includes in its territory the states of Illinois, Iowa and Wisconsin, and parts of Indiana and Michigan.

The brick and clay products committee anticipated an increase of 10% in their shipments, while an increase of from 8 to 10% is expected by the cement committee. A 5% increase is predicted in the movement of lumber, and an 8% increase in paper and pulp. The sand, gravel and stone committee reported an expected increase of 15%, while the movement of silica sand is expected to show a 5% increase.—*Chicago Journal of Commerce*.

New South African Cement Mill

WHITE'S South African Cement Co., Ltd., is to have a site surveyed at Hankey near Port Elizabeth, Cape of Good Hope, South Africa, on which a new cement mill will be erected. Following the survey, plans and design will be made at the London, Eng., office of the company. A limestone deposit has been acquired about three miles from Hankey in the Gambos River valley and about 40 miles from Port Elizabeth.

The company is a subsidiary of the Associated Portland Cement Manufacturers, Ltd., and the British Portland Cement Manufacturers, Ltd., London, England.

Florida to Establish Clay-Testing Laboratory

A CLAY-TESTING laboratory to determine the commercial value of various clay deposits throughout Florida will be established at Tallahassee during the summer by the state geological department.

While the laboratory is testing samples of clays obtained by attaches of the department in various parts of the state, it will search first for one thing in particular, a clay which will burn white. Florida has large deposits of lime rock and if there are deposits of white burning clay anywhere in the state it will have the raw materials for white cement. If the white burning clay can be found, the white cement manufacturing industry can be established in Florida on a successful basis at the outset, it is said, for the demand for white cement is quite large.

Cement Mill Men Discuss Safety at Detroit

CEMENT mill operators and representatives from Michigan, northern Ohio and northern Indiana held a regional safety meeting in the Chinese room, Book-Cadillac hotel, Detroit, Mich., on July 12. The conference was co-operative with the National Safety Council and the Red Cross in developing methods to reduce accidents within the industry.

The convention was opened at 10 o'clock by registration and followed by the morning program, conducted by Colonel William M. Hatch, president of the Peerless Portland Cement Co., chairman of the local committee.

A. J. R. Curtis, assistant to the general manager of the Portland Cement Association, outlined the recent progress of safety work in the cement industry. A. M. Williams, director of safety work, Chrysler corporation, spoke on "Successful First Aid Work," and A. Moreau of the American Red Cross gave a practical demonstration of safety work.

Other speakers for the day were: John W. Boardman, vice-president of the Huron and Wyandotte Portland Cement Co.; O. J. Lingeman, vice-president, Aetna Portland Cement Co.; J. W. Koster, E. I. Du Pont de Nemours Co.; G. H. Cam, power and safety engineer, Canada Cement Co., and Eugene J. Brook, Michigan state labor commissioner.

J. B. John, chairman of the committee on accident prevention and insurance of the Portland Cement Association, presided as toastmaster at the banquet at 6:30 o'clock, which closed the conference.

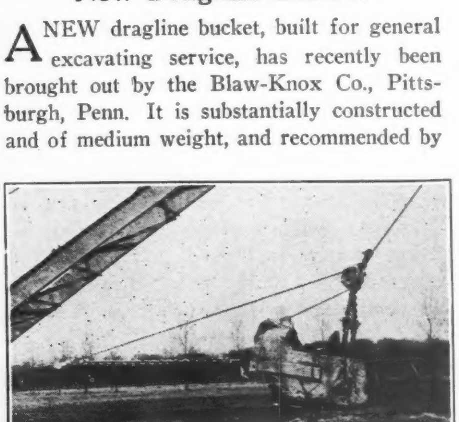
Spanish Potash Production

A SPANISH ministerial decree fixes the production of potash salts in Spain at a maximum of 60,000 tons and a minimum of 15,000 tons, the content of potassium chloride being 80% in both cases. Not more than 25% of the total output may be exported.—*Chemistry and Industry*.

New Machinery and Equipment

New Dragline Bucket

A NEW dragline bucket, built for general excavating service, has recently been brought out by the Blaw-Knox Co., Pittsburgh, Penn. It is substantially constructed and of medium weight, and recommended by



New dragline bucket

the manufacturers for stripping operations. The illustration shows the 35 size, 1¼-cu. yd. capacity, on a 45-ft. boom.

Some of the features claimed for the new bucket are simple, clean-cut design; rugged, durable construction; long life of wearing parts assured by use of hard alloy-steel lips, trunnion link bushings, drag-chain connection bushings; clean, rapid dumping; headroom kept to minimum; increased yardage resulting from improvements in design, and less dead weight without sacrifice of strength.

Compressed Air Separator

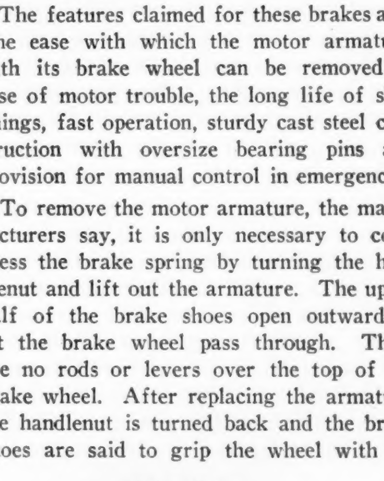
SMITH-MONROE CO., South Bend, Ind., have recently put out the "Gast" compressed air separators for separation of oil and water particles from the individual air lines supplying compressed air to pneumatic tools. Through the use of this separator, it is claimed that maintenance costs and repairs on air tools is considerably reduced and deterioration of air hose lessened appreciably.

The operation of the separator is as follows:

The compressed air entering the separator at the inlet passes upward, striking the top of the inner chamber, where it is then deflected downward and out the slots through several thicknesses of coarse mesh brass screen, striking the wall of the outer chamber and then deflected up and out the discharge opening.

As the air zigzags through the several thicknesses of screen, the heavier particles collect on the individual strands and drop into the dead space created in the bottom of the chamber by the passage of the air. To forestall any capillary action, a projection is cast in the upper portion, this forming an upper chamber, which is at all times entirely free of any trace of moisture.

The separators are made with ¾-in. and 1-in. inlet openings and are installed on the individual lines at the air hose connection point.



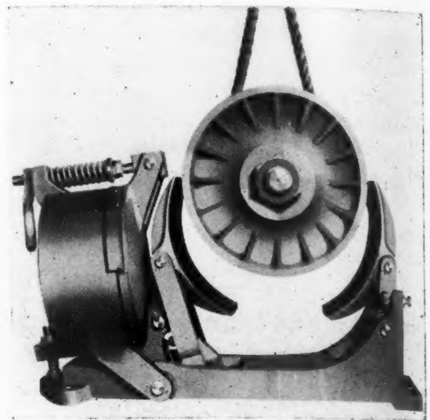
Compressed air separator for use with air lines

New Shoe-Type Brake for Rock Products Machinery

A NEW direct current, shoe-type brake for cranes, hoists, cement mill machinery, etc., the "WB," is announced by the Electric Controller and Manufacturing Co., Cleveland, Ohio.

The features claimed for these brakes are: The ease with which the motor armature, with its brake wheel can be removed in case of motor trouble, the long life of shoe linings, fast operation, sturdy cast steel construction with oversize bearing pins and provision for manual control in emergencies.

To remove the motor armature, the manufacturers say, it is only necessary to compress the brake spring by turning the handlenut and lift out the armature. The upper half of the brake shoes open outward to let the brake wheel pass through. There are no rods or levers over the top of the brake wheel. After replacing the armature, the handlenut is turned back and the brake shoes are said to grip the wheel with the



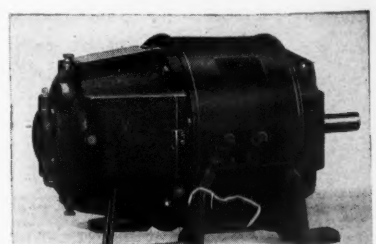
Electric shoe-type brake

original adjustments remaining undisturbed.

Thickness of brake shoe linings is ½-in., allowing ¼-in. wear on the smallest size; and ¾-in., allowing 7/16-in. wear on the largest size. In case of power failure or motor trouble on a crane, an overhauling load, it is said, can be lowered and accurately controlled by manual operation from the handlenut. The brakes are claimed to be quick acting because the light armature plate moves through a short air gap while the heavy magnet remains stationary.

New Room Hoist Motor for Mines

A NEW type RH, totally enclosed motor, rated at 5 hp., 15 minutes, 55 deg C. temperature rise, 1150 r.p.m., compound wound, 115, 230 or 550 volts, has been developed by the Westinghouse Electric and



Motor for mine hoists

Manufacturing Co. particularly for use on portable type room hoists in mines. Many design and operating features make it especially applicable for this kind of service. Across-the-line starting is permitted with negligible disturbance at the commutator, it is claimed.

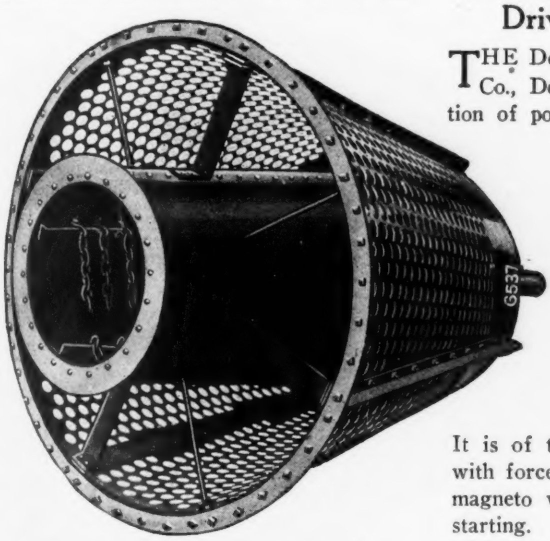
The armature coils are so constructed and installed that a single coil can be replaced with small disturbance of the other coils.

Each coil is insulated and the completed armature is impregnated and baked. The shunt and series coils for one pole are assembled as one unit and are dipped and baked in this form.

The RH motor has a rolled steel frame and drop forged steel feet which are welded to the frame. The bearings are heavy duty roller type and the motor can be operated in an inclined position. The enclosing covers are hinged to the bracket and can be raised for inspection of the brushes and commutator by loosening one screw. There are a total of four covers, giving good access to these parts.

Combination Screen and Scrubber

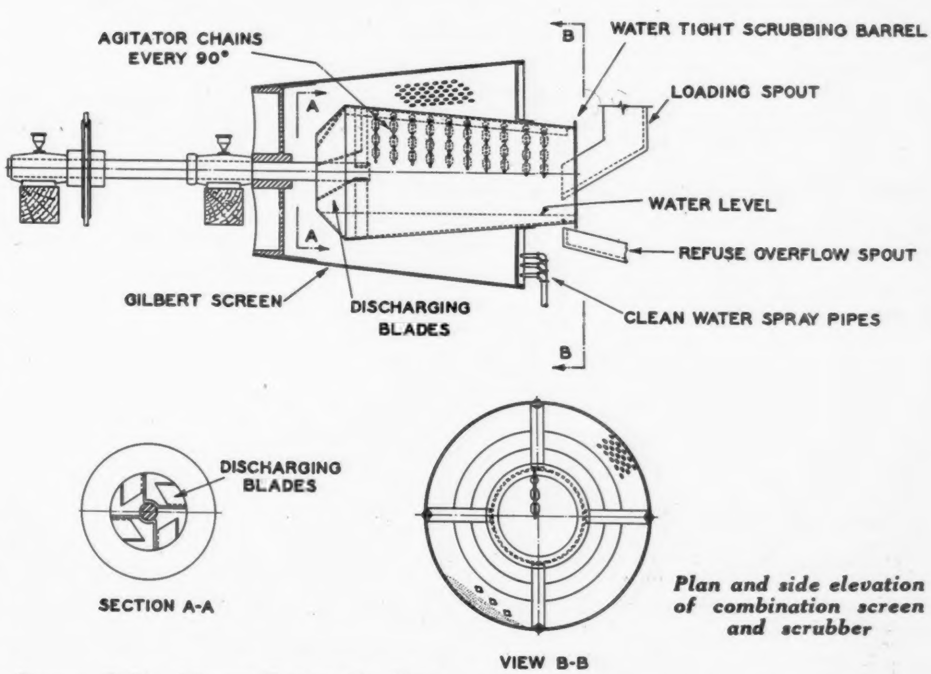
THE "Columbia" scrubber, a combination of screen and scrubber for scrubbing aggregate and making one separation, has been recently brought out by the Stephens-Adamson Co., Aurora, Ill. It consists of a scrubbing barrel inside the Gilbert screen. Material is delivered to the inside of the water-tight scrubber-barrel where short lengths of chains fastened at 90 deg. intervals agitate the material and with the water loosen and remove the dirt. When the material reaches the end of the tube, fixed blades discharge the aggregate to the inside of the screen for final washing and the first separation.



Combination screen and scrubber for scrubbing aggregate

The initial scrubbing action given the bank material prior to the introduction into the separating screen is said to be very effective in loosening dirt from the gravel and breaking up mud and clay balls.

Some recent installations of the new machine have been made at the Marshall Sand Co., Ellerson, N. C.; Consolidated Rock Products Co., Brooksville, Fla.; Guggenheim Bros., Tocopilla, Chile; Holston Quarry Co., Strawberry Plains, Tenn.; W. P. McGeorge & Co., Cherry Valley, Ark.; Orange County Rock and Gravel Co., Orange, Calif.; Western Paving Co., Harjo, Okla., and the Wolf River Sand Co., Memphis, Tenn.



Plan and side elevation of combination screen and scrubber

New Line of Gasoline Engine Driven Air Compressors

THE Denver Rock Drill Manufacturing Co., Denver, Colo., announces the addition of portable gasoline engine driven air compressors to its line of pneumatic tools. The three compressor sizes are 6x4½-in., 8x6-in. and 9½x6-in. bore and stroke, providing a selection suitable for the operation of a varying number of rock drills, concrete breakers, air hoists, etc.

The engine is of standard make, designed for heavy duty. It is of the four-cylinder, "L" head type, with force feed lubrication. A high tension magneto with impulse starter insures easy starting. A governor controls engine speed with the maximum r.p.m. limits. The carburetor is simple and efficient.

The engine drives a single acting, duplex, vertical compressor through a flexible, quickly detachable coupling. The compressor is well water jacketed, with balanced crankshaft to minimize vibration. Suction and discharge valves are of the Duo Plate type and operate with a low lift.

The frame is a single piece steel casting, with air receiver and gasoline tank mounted on an extension to the rear. Cooling is effected by means of a large sectional radiator, which is protected by heavy steel rods. The unloading device is automatic and positive, and when the compressor is operating in the unloading position the engine is cut to idling speed by means of a carburetor throttle control mechanism.

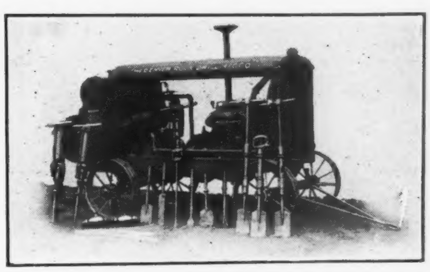
This line of portable machines can be supplied on any standard mounting. They may be skid mounted, mounted either on steel or rubber tired wheels, or on trailers, and the small size is suitable for mounting on a Ford truck.

Denver Company in Merger

ANNOUNCEMENT is made by W. H. Leonard, chairman of the board of directors, Denver Rock Drill and Manufacturing Co., Denver, Colo., that final negotiations for the merger of the company with the Gardner Governor Co., Quincy, Ill., have been concluded, predicated on an appraisal of both companies' plants and an audit. A new company to the known as the Gardner-Denver Co. will be organized under the laws of Delaware to acquire the assets of both companies. The full list of directors has not yet been announced, but it is stated that J. W. Gardner is to be chairman of the board and W. H. Leonard, president.

The consolidation is expected to assist materially in increasing sales and economies in manufacture, shipping, etc., according to the announcement. The individual companies do not overlap, so both can continue manufacturing their present lines as usual.

The Denver company was organized about 21 years ago and its line of rock products equipment established in the industry. The Gardner company is older, having been in business for 68 years.



Portable gasoline engine-driven air compressor

News of All the Industry

Incorporations

Elkan Stone Tile Mfg. Co., Macon, Ga. Stanley A. Elkan and others.

Putnam Sand Co., St. Augustine, Fla., $10,000. E. N. Calhoun and Gertrude E. Calhoun.

National Asbestos Co., Plumtree, N. C., $150,000. E. C. Guy, D. T. Vance and R. Todd.

National Sand and Gravel Co., Omaha, Neb., $50,000. David S. Warr, A. E. Royce and others.

Bedford-Carthage Stone Corp., Houston, Tex., has increased its capital from $30,000 to $100,000.

Jackson & Squire, Inc., Hartford, Conn., $110,000. To manufacture and deal in cement, plaster, etc.

Pennsylvania Glass and Sand Corp., Philadelphia, Penn., $6,000. J. C. Brown of Ardmore, Penn.

Owen Sound Cement Co., Ltd., Owen Sound, Ont. Deal in cement, lime, plaster and artificial stone.

E. J. Bartells Co., Seattle, Wash., $25,000. To deal in cement products. E. J. and R. B. Bartells.

Enid Sand and Gravel Co., Enid, Okla., $50,000. J. L. Neuner, O. C. Calvert and Ed Fleming, all of Enid.

Gypsum Products Corp., Seattle, Wash., $400,000. George O. Gray, Kenneth McLeod and C. A. Riddle.

Superior Gravel Co., Houston, Tex., $10,000. W. K. McCardwell, Wm. Donnelly and Frank J. Schlueter.

Canada Lime Products Co., St. Marc des Carrieres, Canada, $20,000. To produce lime and crushed stone.

Astoria Concrete Products Co., Astoria, Ore., $10,000. W. M. Bellinger, Juanita Bellinger, J. W. Ellis and others.

New Jersey Sand and Gravel Co., Spring Lake, N. J., 17,500 shares no par value. (Geran & Matlack, Asbury, N. J.)

Italian Mosaic and Marble Co., Ltd., Toronto, Canada, has increased its capitalization from $25,000 to $100,000.

Keystone Rock Co., Asheville, N. C., $100,000. Mary W. Bohannon, John N. Bohannon, 75 Macon Ave., and J. D. McGahey.

Morro and Steiner Concrete Block Co., Irvington, N. J., 1200 shares no par value. Max W. Meisner, Newark, N. J.

Concrete Products, Ltd., 901 Standard Bank Bldg., Vancouver, B. C., $10,000. To manufacture and deal in cement products.

J. W. Stephens Roofing Tile Corp., 1004 N. Crawford St., Dallas, Tex., has increased its capital stock from $25,000 to $50,000.

Detroit Concrete Construction Co., Detroit, Mich., 100,000 shares of no par value. To manufacture and sell concrete products.

Midwest Sand and Gravel Co., Muskogee, Okla., $250,000. J. A. De Witt of Muskogee, R. W. Keller and O. E. Winzor of Chicago, Ill.

Lagrand Limestone Co., Wilmington, Del., $85,000. Produce stone, limestone, marble and lime. (Corp. Trust Co. of America, Wilmington.)

Succassuna Sand and Gravel Corp., Succassuna, N. Y., $100,000 preferred stock, 250 shares no par value. H. Ely Goldsmith, New York, N. Y.

Crystalite Corporation of Washington, Seattle, Wash., $100,000. To manufacture artificial stone. Charles Tanner, Robert A. Devers and others.

Felice Trachina, Inc., New Orleans, La., $15,000. To operate crushing plants. Felice Trachina, 2102 Dublin St.; E. Howard McCaleb and Delia Burke.

Crowell & Foster, Inc., Statesville, N. C., $100,000. To manufacture concrete blocks. G. L. Crowell of Statesville, L. L. Foster and R. G. Foster of North Wilkesboro.

Premier Cement Brick and Tile Co., Ltd., Northern Ontario Bldg., Toronto, Canada, $100,000 and 200,000 shares of no par common stock. To manufacture and deal in brick, tile, sewer pipe, artificial stone, cement and lime.

Quarries

Wauwatosa Stone Co., Wauwatosa, Wis., has offered to sell its 24-acre stone quarry site near the Hawley road to the city of Wauwatosa for the stated sum of $4500, according to a local newspaper.

Anna Stone Co., Anna, Ill., has purchased a steam switch engine from the I. C. railroad to replace the electric motor that has been used in the quarry switching service.

A. Violette, Los Angeles, Calif., has leased a deposit of travertine about one mile from Bridgeport, Calif., and has engaged in quarry operations. Judge C. L. Hayes is the principal owner of the deposit.

Carthage Marble Co., Carthage, Mo., has acquired the Ozark quarry and will remodel the plant and install new machinery.

Holston Quarry Co., Inc., Strawberry Plains, Tenn., is adding a revolving steam shovel of the crawler type to its equipment.

Georgia-Quincy Granite Co. and Sparta Crushed Stone Co., Sparta Ga., have purchased a Telsmith rock crusher from the Smith Engineering Works, Milwaukee, Wis., to be installed at their Granite Hill quarries.

Chimney Rock, N. J.—A premature blast at the Bound Brook Crushed Stone Co.'s plant on July 12 injured four men. One lost a hand, another was seriously injured and two escaped with minor hurts.

Sand and Gravel

Culver, Ind. A new gravel pit, it is reported, has been opened southwest of this town.

Spring Valley, Ill. The city-owned gravel pit located near the C. B. & Q. railroad viaduct has been opened by Joe Dowling, superintendent of streets.

Alexandria, Ind. A new gravel pit has been opened on the Jones farm near Anderson, Ind.

Brown & Rosenbarger Gravel Co., Indianapolis, Ind., is erecting a gravel elevator at their pit on the Puckett farm. The company has the contract for about 100,000 tons of gravel for the Indiana highway commission.

Arkansas Sand and Gravel Co., Van Buren, Ark., has resumed operation after a shutdown of several weeks caused by flood conditions.

Sanilac, Mich. The Sanilac road commission has built a screening plant which has been installed at the gravel pit south of Lexington.

Bagnell, Mo. The state prison board of Missouri has leased the Bagnell gravel plant for two years. The plant is to be operated by convict labor and the product will be used in constructing the new prison additions.

Union Rock Co., Builders Exchange Bldg., Los Angeles, Calif., is about to begin construction of 4000-ton rock bunkers on 5½-acre tract recently purchased at Santa Fe main line and Atlantic Ave., Los Angeles, Calif.

Tennessee Sand and Gravel Co., Florence, Ala., Capt. J. S. Wilson, manager, has enlarged and extended its plant.

Charles B. Jacobs has purchased the business of the Rock Valley Sand and Gravel Co. at Rock Valley, Iowa.

Crystal Sand Co., Mission, Tex., W. H. Wood, president, will develop 35 acres and will install an 8-in. sand and gravel pump to raise material 35 ft. through 300 ft. of discharge line.

Silica Sand

Monroe, Wis. Robert Wehenn, who recently discovered silica sand deposits near Browntown, Wis., has leased the property and is now trying to encourage the location of a glass manufacturing plant in Monroe. He shipped a ton of the sand to the Inland Glass Mfg. Co., in Chicago, Ill., for test purposes. The results of the test showed the unwashed sand to contain 98.50% silica, 1.06% alumina, 0.031% iron oxide and a loss on ignition of 0.14%.

Cement

Signal Mountain Portland Cement Co., Chattanooga, Tenn., recently announced the following appointments: Frank G. Conkling, director of sales; Irving F. Sisson, assistant sales manager; J. Dan Bowden, special representative.

Sandusky Cement Co., Cleveland, Ohio, was host to the building supply dealers of Columbus, Ohio, at a golf tournament held at the Willwick Country Club near Cleveland. A. T. McCormack, sales manager, was in charge.

Volunteer Portland Cement Co., Knoxville, Tenn., has let the contract for the stock and pack houses to the Burrell Engineering and Construction Co., Chicago, Ill. The first section of the plant railroad, beig built by the Dempster Construction Co., is nearly completed.

Bessemer Limestone and Cement Co., Bessemer, Penn., has just completed one year without an accident to any of its employes.

Lehigh Portland Cement Co.'s New Castle, Penn., plant has completed one year without a lost-time accident to any of its employes.

Cement Products

Jacobson & Co., New York, N. Y., manufacturers of artificial stone, ornamental plaster and sculpture, have established a branch office in the Fine Arts Bldg., Los Angeles, Calif., with T. R. Jacobson in charge.

Plastic Products Co., San Antonio, Tex., has purchased a group of buildings which will be used to carry out its expansion program.

Independent Concrete Pipe Co., Indianapolis, Ind., is planning the enlargement of its operation to include 48-in. reinforced concrete sewer pipe.

Arnold Stone, Brick and Tile Co., Jacksonville, Fla., N. Von Glahn, Lem Turner Road, secretary, will erect an ornamental stone plant.

Elk River Concrete Products Co., Elk River, Minn., is about to begin construction of a plant in Helena, Mont.

Dalles Cement Products Co. has been formed by Neil McFadgen and L. L. Tauscher in The Dalles, Ore.

Valley Concrete Pipe and Products Co., Yuba City, Calif., has begun the construction of a plant to cost about $40,000, at Stege, Calif. G. D. Williamson is president and J. G. Williamson is vice-president of the company.

M. L. White has engaged in business of manufacturing concrete products at 6916 Santa Monica Blvd., Los Angeles, Calif., as the Los Angeles Supertile Co.

Gypsum

Standard Gypsum Co., San Francisco, Calif., shipped 2000 tons of gypsum to Japan from the San Marcos, Calif., quarry. A shipment of structural gypsum stucco was made to Fairbanks, Alaska, to be used by the United States Smelting Co. for roof construction.

Atlantic Gypsum Corp., Portsmouth, N. H., has inaugurated a night shift at its plant here.

Miscellaneous Rock Products

El Dorado Talc and Rock Products Co., Placerville, Calif., a new company, recently organized by Paul F. Taylor of Placerville, is planning the operation of the quartz deposit at the former Craddock mine and is making plans for a grinding and pulverizing plant.

Federal Graphite Co., Anniston, Ala., recently acquired about 700 acres of graphite lands near here and plans the installation of equipment with capacity for about 500 tons per month. John Lewis, John D. and W. L. McCullough of Birmingham, Ala., are the interested parties.

Asbestos Shingle, Slate and Sheathing Co., Ambler, Penn., has just issued a comprehensive catalog of the asbestos building material which it manufactures. The catalog includes descriptions, methods of application, tables of quantities required, weights of the material, etc. Copies may be obtained by writing the company.

Standard Slag Co. of Ohio, Youngstown, Ohio, is reported to have consolidated with the Coff-Kirby Coal Co.

Personals

J. E. Zahn, Denver, Colo., secretary of the United States Portland Cement Co., has been elected vice-president of the Denver Chamber of Commerce, to represent the department of finance.

Paul D. Cravath of New York, for 30 years general counsel for the Westinghouse Electric and Manufacturing Co., has been elected temporary chairman of the board of directors to fill the vacancy caused by the death of General Tripp.

Paul J. Lynch who for the past several years has been building dams in the west has been appointed sales manager of the General Excavator Co., Marion, Ohio. Mr. Lynch just recently completed the big dam just below the Roosevelt dam in Arizona.

W. L. Mellon, Pittsburgh, Penn., has been elected to the board of directors of the Westinghouse Electric and Mfg. Co.

Charles F. Simpson has been appointed by the Portland Cement Association as district engineer for Tennessee, with offices in the Cotton States Bldg., Nashville, Tenn.

Frank M. Traynor has been appointed director of sales for the Florida Portland Cement Co., Tampa, Fla.

J. Ekland, formerly with the United States Gypsum Co. as designing and developing engineer, intends to engage in consultation work in connection with the design and operation of lime and gypsum plants, with offices in Chicago.

J. W. Marshall has joined the Quigley Furnace Specialties Co., New York, as advertising manager. Mr. Marshall comes to the Quigley company direct from the Westinghouse Electric and Mfg. Co., where he was manager of the publicity division of their Pittsburgh office. He has specialized in industrial advertising and has been connected in the past with the American Nickel Corp., where he served as assistant sales manager, and G. P. Blackiston and staff, as manager of the creative division. He is a member of the American Society of Mechanical Engineers and a graduate of Cornell University. His headquarters will be at the company's New York office, 26 Cortlandt St.

R. E. Boggs has been appointed distributor of Armstrong Mfg. Co. blast hole and water well drilling machinery in the states of Alabama and Georgia, with headquarters at Birmingham, Age-Herald Bldg.

J. A. Dunn has become chief engineer of the American Hume Concrete Pipe Co., Detroit, Mich., the American licensees of the Australian Hume developments. He succeeds W. D. Kimmel, who has resigned to take over the management of the Detroit Hume Pipe Co., the Michigan licensees for the Hume process. Mr. Kimmel has been with the company since its inception two years ago.

Mr. Dunn was formerly assistant secretary of the American Concrete Pipe Association and later chief engineer for the Independent Concrete Pipe Co., Indianapolis, Ind.

Obituaries

Henry Gepfert, vice-president of the Jaeger Sand and Gravel Co. of Milwaukee, Wis., was found dead in the water of the company's gravel pit on Curtis road, July 2, after he had been missing for two days. It is thought that he was overcome by the heat and fell into the pit and drowned.

Henry Gillette, former owner and manager of the River Sand and Gravel Co., Winona, Minn., died recently in Sierra Madre, Calif.

Manufacturers

Ingersoll-Rand Co., New York, has opened a branch office at 236 High St., Newark, N. J. F. K. Armstrong, formerly of the New York sales office, is the manager.

Lakewood Engineering Co., Cleveland, Ohio, announces the appointment of the T. J. Lane Equipment Co., Springfield, Ohio, as agent for the central Ohio territory and the Mechanical Supplies Co., Cincinnati, Ohio, the agent for Cincinnati and adjacent Kentucky territory, with J. B. Miller in charge of sales.

Harnischfeger Corp., Milwaukee, Wis., recently opened a branch office at 330 Gateway Bank Bldg., Minneapolis, Minn. P. H. Sackett, district manager, is in charge and J. C. Yetter, sales engineer, is his assistant in the Minneapolis territory.

Pennsylvania Pump and Compressor Co., Easton, Penn., announces the appointment of the P. I. Perkins Co., 110 High St., Boston, Mass., representative for the Boston territory.

Climax Engineering Co., Clinton, Iowa, have just issued a series of booklets, 8½x11, averaging 40 pages each, containing parts price lists and operation instructions for their Models R6U, R4U and TU engines and power units. Each of these books contains detailed lists of parts with illustrations of each part, complete instructions for the care, operation and adjustment of each engine, as well as other pertinent information which might be needed by the user of Climax engines. Copies of these parts books will be sent on request.

Harnischfeger Corp., Milwaukee, Wis., recently exported 11 of their latest model excavators to Cuba. These 11 machines are now working on the longest paved highway ever covered by a single contract.

More-Jones Brass and Metal Co. has reorganized and is now a division of the National Bearing Metals Corp., recently incorporated, with general offices at 4930 Manchester Ave., St. Louis, Mo. The following firms are also divisions of the National Bearing Metals Corp.: Bronze Metal Co., Meadville, Penn.; Bronze Metal Co., Jersey City, N. J.; Damascus Bronze Co., Pittsburgh, Penn.; Keystone Bronze Co., Pittsburgh, Penn., and Southern Brass Co., Norfolk, Va. The new company will assume all contracts and obligations of the above named firms.

Trade Literature

NOTICE—Any publication mentioned under this heading will be sent free unless otherwise noted, to readers, on request to the firm issuing the publication. When writing for any of the items kindly mention ROCK PRODUCTS.

Hoists. Bulletin No. **130** on dragline and slackline hoists, electric, steam or gasoline engine drive. MEAD-MORRISON MANUFACTURING CO., Boston, Mass.

Industrial Steel. General catalog on steel rails, special rail sections, portable track, angles and other track equipment. Complete tables on rails and accessories. SWEET'S STEEL CO., Williamsport, Penn.

Centrifugal Pumps. Bulletin No. **W-613** on ball bearing centrifugal pumps for general service, types H, L, M, R, S and U. Details on design and construction, performance data, etc. WORTHINGTON PUMP AND MACHINERY CORP., New York, N. Y.

Portable Air Compressor. Bulletin No. **133**, giving data and specifications on Model "121" Pennsy-Portable air compressor. PENNSYLVANIA PUMP AND COMPRESSOR CO., Easton, Penn.

Marion Shovel-Crane-Dragline, Type 7. Bulletin No. **318** giving details of the steam drive; No. **319** on the gas-electric drive, and No. **320** on the straight-gas drive. Details of construction, capacities, working ranges, illustrations of design, etc. MARION STEAM SHOVEL CO., Marion, Ohio.

Suggestions to Competitors for the 1927 Arc Welding Prize

AS a guide to competitors in the Lincoln Arc Welding Prize for 1927, consisting of $17,500 given by the Lincoln Electric Co. of Cleveland, Ohio, and administered by the American Society of Mechanical Engineers, 29 West 39th Street, New York City, the donors have expressed the following suggestions:

Practicable, workable ideas will get more consideration than ideas in which the practicability is open to question. The problem is to develop or extend the field of usefulness of electric arc welding and make material and labor savings by its use. The object of each entrant should be to make concrete and practical application of the known facts and principles. The application should preferably be made in the field in which the entrant is at present engaged, so that accumulated knowledge in that field will be available and that the chance of the suggestion being impractical will be reduced to the absolute minimum.

It is probable that the entrant will find that the best way to go at the job will be to study all the technical literature available on the subject of electric arc welding, then apply the facts and principles to his own business or branch of engineering activity.

To simplify the effort required to understand what has been done with electric arc welding up to the present time, the classification given below may be profitably considered.

(1) Welding in place of riveting on structural steel shapes and on hot-rolled plate.

(2) Replacement of gray iron, malleable, and steel castings with welded steel equivalent, built up from hot-rolled steel plates and shapes.

(3) Welding of non-ferrous metals.

(4) Welding for maintenance and repair of existing machinery, equipment and structures made of metal.

The winners of arc welding prize for 1927 will be largely selected on the basis of amount of economic saving that the suggestion submitted shows either directly on the design submitted or in its possible wider application. All suggestions should be made with that in mind.

The Lincoln Electric Co. stands ready to assist anyone by suggestions or data upon receipt, and further information can be secured from either the Lincoln company or from the American Society of Mechanical Engineers.

Canadian Non-Metallic Mineral Output in 1926

THE total production of gypsum in Canada in 1926 amounted to 878,283 tons, compared with 740,323 tons in 1925. Imports of gypsum amounted to 6298 tons in 1926, as against 8921 tons in 1925, and Canadian crude gypsum exported, principally to the United States, totalled 668,064 tons in 1926. Ground gypsum and prepared wall plaster exported during the year totalled 10,062 tons, the United States, Newfoundland, Australia, and New Zealand being the chief importers of these materials. In 1926 the tonnage of magnesite produced in Canada decreased, but there was a considerable increase in value. The 1926 shipments were recorded as 4571 tons, compared with 5576 tons in 1925, and imports for the two years were 150 tons against 111 tons respectively, exports totalling 653 tons in 1926 and 834 tons in 1925. The International Magnesite Company and the Scottish Canadian Magnesite Company were the only producers of this material in Canada. Production of quartz in 1926 totalled 218,121 tons (197,224 tons in 1925) and imports of silex and crystallized quartz to a total of 2554 tons and of flint to the amount of 4731 tons were recorded during the same year. During 1926 Canada's salt output continued to increase, the high record of 233,746 tons in 1925 being surpassed by a production of 262,547 tons in 1926. Natural sodium sulphate shipped from Canadian deposits during 1926 amounted to 6775 tons, as compared with 3876 tons in the previous year.